FEBRUARY 28, 1955

NEWS ISSUE

Electrical World

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A McGRAW-HILL PUBLICATION

THE PURCHASING AGENT LOOKS AT..... PRICES

page 15

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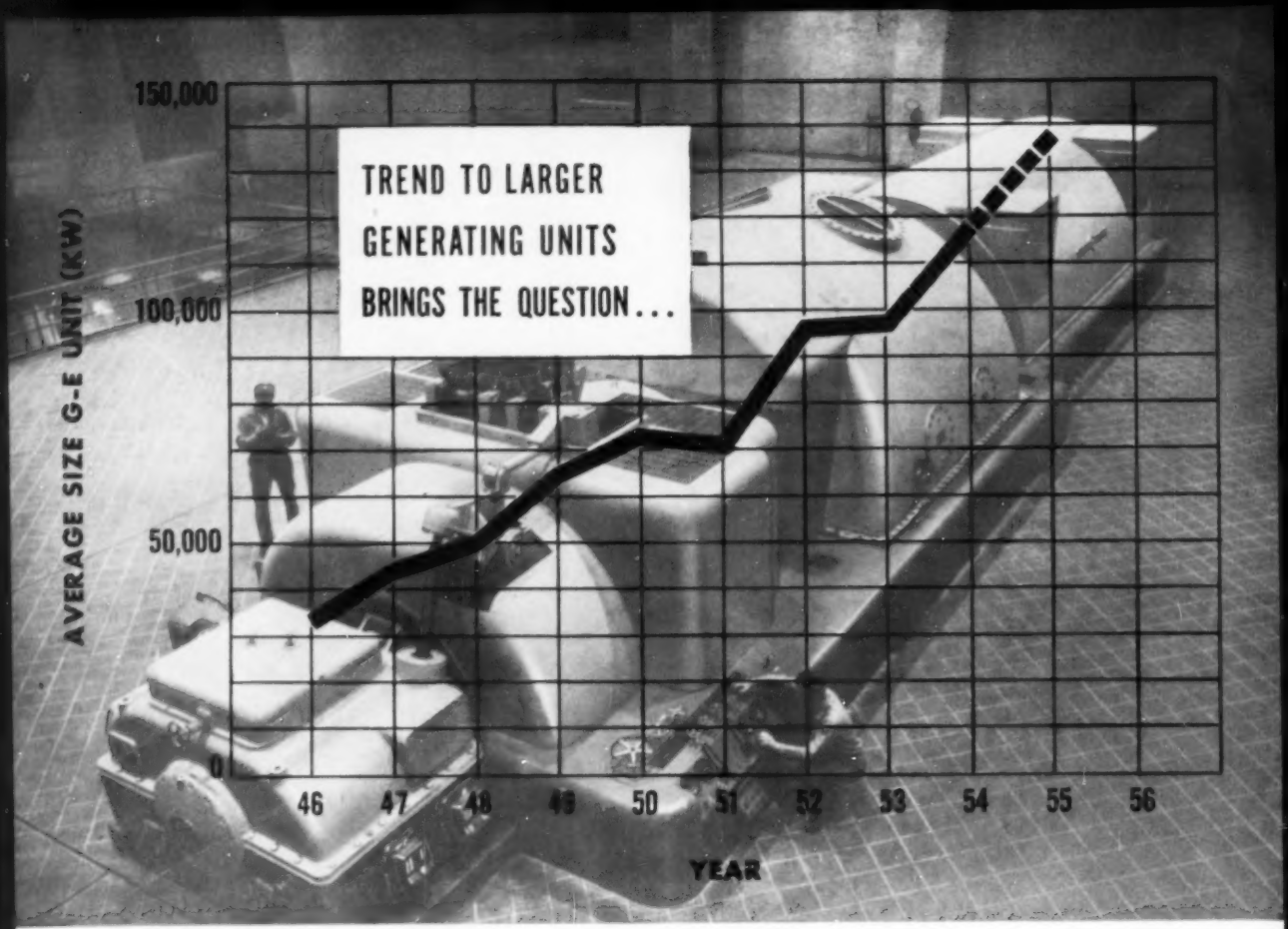

What size machine is most economical?

TREND TO LARGER UNITS, discussed here by A. G. Mellor (right) and Dr. L. K. Kirchmayer, G-E electric utility engineers, is revealed in estimates that average 1955 G-E units will be four times the average size of 1946 units.

Spurred by load growth trends, many electric utilities are now evaluating investment costs, reserve requirements, labor costs, transmission losses, interconnection facilities, and heat rates to determine the best size of generating equipment to meet system expansion.

Application of methods developed in recent General Electric studies to individual systems should help utilities reach the most suitable answer. In general, large generating units are the economical choice.

LARGER UNITS FAVORED

As load growth dictates additional generation, operating economies generally favor the larger units, based on generation costs and manpower requirements. Sometimes investment charges are higher when large units are used, because of increased reserve requirements. However, these fixed costs are often offset by reduced fuel requirements for the portion of the load that the newer unit takes over from older, less efficient machines.

A typical analysis points to units of 7% to 10% of system size as the economic way to add capacity.

500,000-KW UNITS

With G.E. constantly making technological developments, units of 350,000 kw are under engineering consideration and units of 500,000 kw are possible in the future.

If load growth follows today's patterns, large generating equipment may prove extremely rewarding. For more complete information on determining the optimum size of generating units, contact your G-E Apparatus Sales Representative, or write for bulletin GER-1030 to General Electric Company, Schenectady 5, N. Y. 301-284

MORE POWER TO AMERICA

GENERAL ELECTRIC

Electrical World

Vol 143 No 9 February 28, 1955

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COMING NEXT WEEK—Keeping distribution maps up to date is a tough job these days, but Dayton Power & Light Co has developed a simplified method which saves time for the engineers. In next week's issue the chief electrical engineer explains the method.

What is the economical distribution transformer size for any location? Indianapolis Power & Light has one answer.

Published for 81 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

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ELECTRICAL WORLD

Published weekly by McGraw-Hill Publishing Co., Inc., Executive, Editorial, and Advertising Offices: McGraw-Hill Building, 330 West 42nd Street, New York 36, N. Y. Publication Office, 99-129 North Broadway, Albany 1, N. Y.

Donald C. McGraw, President; Willard Chevalier, Executive Vice President; Joseph A. Gerardi, Vice President and Treasurer; John J. Cooke, Secretary; Paul Montgomery, Executive Vice President, Publications Division; Ralph B. Smith, Vice President and Editorial Director; Nelson Bond, Vice President and Director of Advertising; J. E. Blackburn, Jr., Vice President and Director of Circulation.

Subscriptions: Address correspondence to Electrical World—Subscription Service, 99-129 North Broadway, Albany 1, N. Y. or 330 W. 42nd St., New York 36, N. Y. Allow one month for change of address.

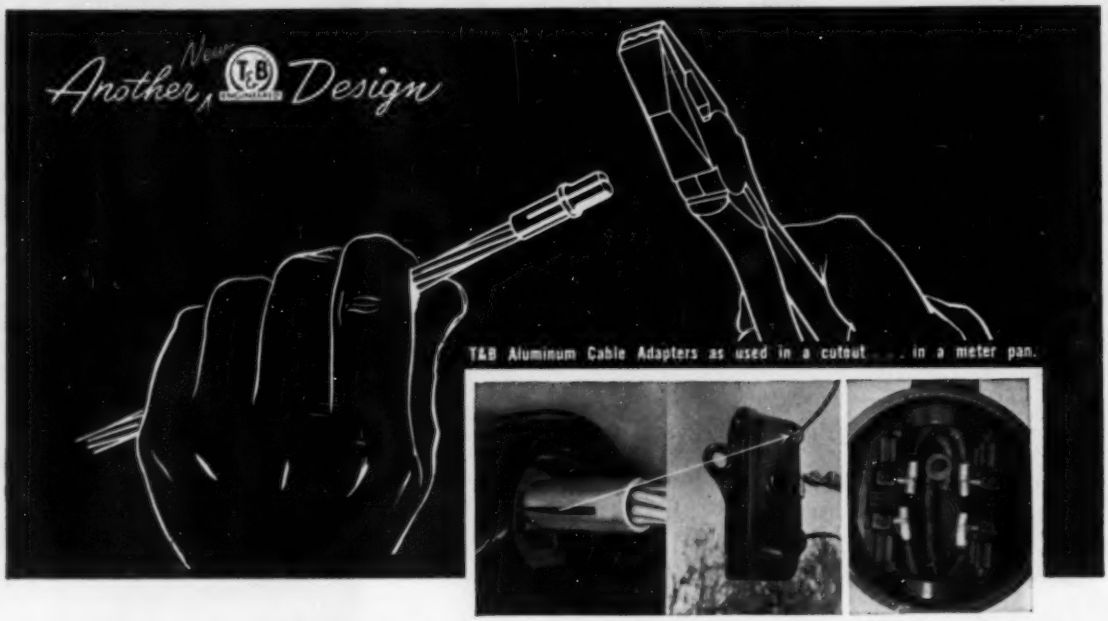
Subscriptions are solicited only from executive, supervisory, and engineering personnel in electric utilities, manufacturing companies, and related fields. Position and company connection must be indicated on subscription orders.

Single copies 25¢. For the United States and possessions $6 a year, $9 for two years, $12 for three years. Canada, $7 for one year, $11 for two years, $14 for three years. (Canadian money, at par.) Other Western Hemisphere, and the Philippines, $15 for one year, $25 for two years, $30 for three years. All other countries $25 for one year, $40 for two years, $50 for three years. Entered as second-class matter at the Post Office at Albany, N. Y. Printed in U.S.A. Copyright 1955 by McGraw-Hill Publishing Company, Inc. Permission required to reproduce any of contents.

IF YOU'RE WIRING WITH ALUMINUM . . .

Utility Engineers are now installing aluminum cable in many places where only copper had been suitable. Equipment such as transformers, capacitors, cutouts, switches, and meter pans, having terminals designed for copper conductors, are now being wired to aluminum and A.C.S.R. with little or no difficulty.

How? T&B's new Aluminum Cable Adapters. They're made of heavily-tinned copper alloy; take up little more space than the cable; install in a jiffy. A lineman or electrician merely taps one onto the end of the conductor, then clamps the adapter as though it were copper conductor. "Straight" and "flag" types are available. The flag type is best for connections at right angles to cable outlets.



One of the outstanding features of these new adapters is the serrated bore. As the adapter is tapped onto the cable, the serrations bite through the aluminum oxide coating. The high-conductivity connection thus formed is maintained, despite weather and moisture, by an oxide inhibitor precoated in the bore. The clamp end is slotted and spring-like to maintain pressure during thermal expansion and contraction.

These versatile Cable Adapters are opening up many new applications for aluminum cable. Sizes for cable up to #2 Str. at present. If you're wiring with aluminum, you might possibly have a unique application. If so, let us know about it. We'll be glad to send you a free sample of the adapter and descriptive literature. Write to The Thomas & Betts Co. today.

Note how the bore serrations have scraped through the oxide coating on the cable end.

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MANUFACTURERS OF FINE ELECTRICAL FITTINGS SINCE 1898

EDITORIALS

What's Cooking—Not Electricity

If the gas industry is alarmed over the big bite electricity threatens to take out of its residential heating load (EW, Nov. 29, p 64), it apparently isn't losing any sleep over the future of its commercial cooking.

T. T. Arden, new president of the Gas Appliance Manufacturers Association, told his industry in a year-end round-up recently released: "Use of gas for commercial and industrial purposes continues to zoom. It's no secret that gas cooking now accounts for 95% of the more than 65 million meals served daily in public eating places and institutions; and if the announced programs of highway and institutional construction go ahead on schedule, the commercial (gas) equipment producers are certainly headed for new heights."

With that much of the market going to gas, it leaves a measly 5% and about 3¼ million meals for electricity and all the other forms of cooking.

Business trends today show people are able and willing to pay a little more for something a little better. The mounting demands for residential heating attest to this.

But where does it show up in commercial cooking? Gas, with its old sales weapon of lower cost, is winning by an overwhelming margin.

This is the year for electricity to take a bigger bite in the commercial cooking load. The sales kit is ready. Electrical cooking is cleaner, more adaptable, easier to regulate. It is just a matter of reaching those who want the best.

A Break for Adequate Wiring

Dame Fortune has smiled brightly on the Adequate Wiring movement of late. What with the barrage of publicity, advertising, and, yes, new customer interest, the dice are finally rolling its way.

But probably its biggest break so far came in December when the Federal Housing Administration said it too would like to know more about this matter of adequate wiring (EW, Dec. 20, p 5).

Repeatedly in the past year the industry has been told that it can campaign, run ads, give speeches, and promote plans to its heart's content. But not until it convinces the appraisal "fraternity" that wiring is a true and basic value addition, will AW make much of a dent in new home construction.

Grand potentate of this appraisal lodge is FHA. Last year it insured mortgages on 222,662 units of around 1 million built. That, by any measure, makes it something worth denting. It was obviously the place to start.

Efforts to get some action from FHA have been afoot for sometime. As a result FHA asked the Industry Committee on Interior Wiring Design to offer suggestions for raising the floor on electrical provisions in its Minimum Property Requirements. This was the turn in the tide for which adequate wiring had been waiting. It would be another step in helping the builder to get recognition for value of the wiring he puts into a house.

But the jackpot is a long way off. The Design Committee under Detroit Edison Co's old AW campaigner, Howard Stevenson, promptly turned the job of making the recommendations over to a sub-committee of capable men from all segments of the industry. They have a tough row to hoe.

If visions of FHA-endorsed, 100-amp minimum service dance in our heads, that's probably all they are—visions. Seventy-amp is more likely. But even this is no chicken-feed. Right now FHA is still accepting 30-amp services. Thus, a nice gain if it materializes.

And another nice break for AW.

Batten Down

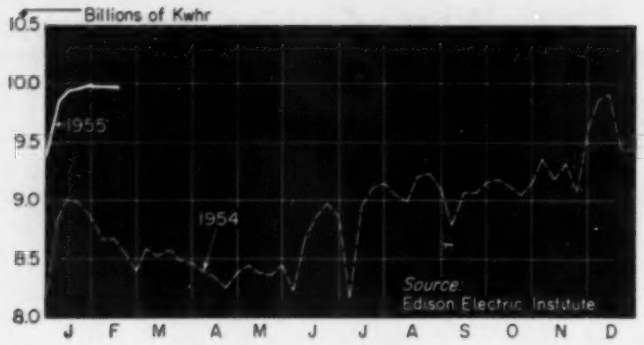
Electric utilities on the East Coast are no longer able to discount hurricanes as a once-in-a-decade hazard. The rapidity with which Edna followed Carol last year was a warning.

Now weather experts come up with the opinion that a change in the pattern of the polar air stream has effected a change in the paths of hurricanes. The shift brings the paths from the open Atlantic to northern areas of the continental United States. No longer can the Long Island and New England areas count on escaping the fury of hurricanes. Even areas further inland are vulnerable as was shown by experience last year.

Perhaps more evidence will be accumulated during the next hurricane season to test the opinion of the weather experts. Meanwhile electric utilities will want to give further consideration to measures not only to restore service quickly but to prevent outages in the first place.

This means system designing to withstand the high winds and battering rains. More attention will have to be given to the location of power lines with respect to trees. It means considering greater use of cable, both aerial and underground, as a means of reducing exposure to storm conditions. It means planning ahead to cope with new weather conditions.

THE ELECTRICAL WEEK



OUTPUT

Week Ended Feb. 19

9,912,000,000 Kwhr

Up 15.9%

Per Cent Change from Previous Year

	Total US	New Eng.	Mid. Atlan.	Cent. Ind.	West Cent.	South-east	South Cent.	Rocky Mount.	Pacific NW	Pacific SW
Feb. 19	+15.9	+9.2	+9.8	+15.9	+9.9	+28.9	+8.6	+16.4	+8.9	+11.2
Feb. 12	+14.3	+5.4	+6.8	+15.4	+8.4	+25.7	+12.0	+12.4	+8.9	+9.3
Feb. 5	+15.8	+9.3	+9.0	+15.3	+9.2	+27.5	+12.0	+12.0	+10.8	+15.6

Seasonally Adjusted Index 185.0 Week Ago 183.6 Year Ago 159.1

The Issue's News Highlights . . . Britain's ten-year atomic program calls for 12 nuclear power stations . . . In announcing power plan for Memphis, Tenn., Mayor Tobey says city is not bluffing about building steam station to supply its needs if TVA can't . . . Delegates at NRECA Atlantic City convention hear nation's co-ops are anxious to obtain use of atomic power . . . Methods for increasing rate of return on utility investment were analyzed at Middle West Service conference held at Biloxi, Miss.

Cyrus Eaton, Sr, who got his start in electric utilities, is increasing his interest in this field again. Cleveland reports state he has bought "heavily" into Kansas City P&L. KCP&L's Pres H. B. Munsell says "no comment."

General Electric, effective Feb. 21, increased interrupting ratings for its complete line of low-voltage magnetic air circuit breakers at 480 v ac and below. GE reports its tests have shown the higher ratings are inherent in its breakers (for more details see p 59).

With Washington Water Power's customers using average 6,910 kwhr annually, "present nationally advocated 100-amp service switch already is obsolete in our area," says Pres Kinsey M. Robinson. Company is out to get its residential customers to install service switches that can be expanded to 200 amps . . . Electrical Association of Philadelphia is lining up contractors and dealers for year-long "100-A" wiring campaign to begin March 19. Philadelphia Electric will tie in with time payment plan covering wiring jobs up to $90, payable with monthly service bills.

Illinois is considering a state atomic energy commission to explore industrial use of the atom . . . Edison Electric Institute has engaged Bechtel Corp to carry out engineering construction supervision of electric structures and equipment to be subjected to atomic blasts at Nevada Test Site in April. Data from test is expected to provide valuable information on effect of atomic explosions on utility facilities.

Pacific Northwest Power is prepared to start construction of dams at Mountain Sheep and Pleasant Valley sites on Snake River within a year after FPC approval, according to Kinsey M. Robinson, president of PNP and of Washington Water Power . . . Interior Department is recommending partnership development of $220-million Trinity River Division of Central Valley Project in northern California. It is estimated government could save $65 million by letting private enterprise build power plants and transmission facilities.

NEWS OF THE INDUSTRY BRIEFLY TOLD

Off the Washington Wire . . . In response to request for its views, Budget Bureau has told Senate Public Works Committee that legislation should be drawn up to let FPC decide whether there should be private development of Niagara power . . . Army Corps of Engineers will hold public hearings in Buffalo March 24-25 on the Corps' plan for ultimate development of 2.5 million kw of power at Niagara Falls. Whatever group finally develops the power will use the Army plan.

Sen Estes Kefauver (D-Tenn.) urges that Senate anti-monopoly subcommittee under Sen Harley Kilgore (D-W. Va.) continue its investigation of utilities, concentrating on electric rates as compared with those of TVA. Kefauver's statement was prompted by his annoyance at Virginia Electric & Power for circulating a speech by Clarence Manion urging immediate sale of TVA.

REA Administrator Ancher Nelsen and his deputy Fred Strong have consulted with Central Electric Power Co-op, Columbia, S. C., and Santee-Cooper on latter's financial troubles. Co-op owes REA $13 million, and has not paid first installment.

Indiana-Kentucky Electric and Madison, Ind., City Council have compromised on city's proposed annexation of site of IKEC's $175-million Clifty Creek plant (EW, Feb. 21, p 84). Council by 4-3 vote has approved ordinance annexing plant site area but not plant itself and land on which it stands.

PS of Colorado has won dismissal of an injunction suit by Union Rural Electric Association of Brighton seeking to block company's service to a 6,000 home residential development in Denver's northern fringe. Co-op contends company's action is violation of a territory agreement, but PSC denies any such agreement exists.

Conflicting claims of United States and State of Oregon involving hydroelectric development at Pelton site on Deschutes River in central Oregon, will be heard by U. S. Supreme Court March 2.

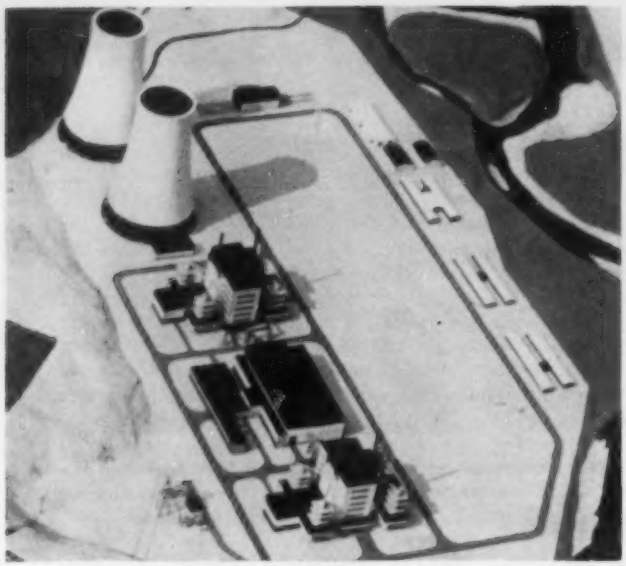
Metal fatigue was cause of breakdown of two huge generators at Ontario Hydro's Richard L. Hearn steam station, Toronto, last April, according to Sir Claude Gibb, chairman of C. A. Parsons & Co, England. This fatigue, he added, was similar to that which caused explosion of British Comet jet air liners.

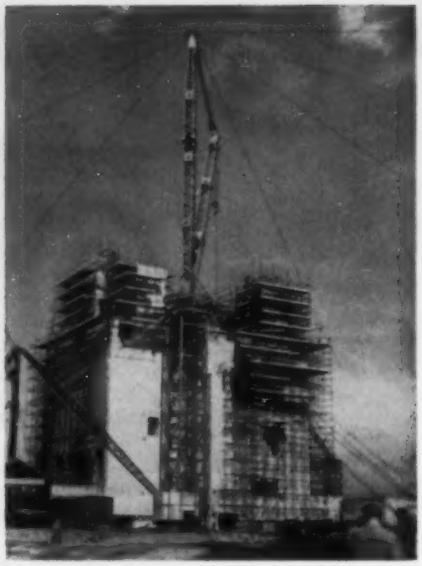
ABOUT PEOPLE IN THE INDUSTRY

FPC is quite capable of deciding Hells Canyon case on its merits, Chairman Jerome K. Kuykendall told Washington and Oregon Chambers of Commerce managers. "I'm amazed at how many experts are speaking up with firm opinions . . . If FPC finds a site should be developed by government it can turn down private application, but must consider latter on its merits in absence of Congressional action. Our agency is arm of Congress, and three successive sessions have declined to approve a Hells Canyon project," he said.

Kansas Gas & Electric has placed much emphasis on mechanizing former hand operations in all departments of the business, Chairman Murray F. Gill told New York Security Analysts last week. "Automatic equipment or supervisory control has been installed to release personnel wherever practical. Sizable expenditures of money and effort for this purpose have held the increase in personnel down to 25% during a period in which the company's business has increased four fold," he said.

More News About People page 36





Calder Hall, with its gas-cooled reactors, is model for . . .

British Plan for 12 Atomic Power Stations

Britain's announcement of a ten-year program for building 12 atomic power stations is paving the way for its bid as a leading industrial nation in the atomic field.

The program, estimated to cost about $840 million, is designed for an initial capacity of 1.5 million to 2 million kw. Britain's present total electric capacity is reported to be in excess of 20 million kw.

'Historic' Move . . . Announcement of the atomic program was made in a White Paper prepared by the United Kingdom Atomic Energy Authority. When the announcement was made, Geoffrey Lloyd, minister of fuel and power, declared: "This is a historic day (Feb. 15) for Britain. I know of no other nation that has yet launched a nuclear power program on this scale."

The British Government reported in the White Paper that by ten years from now new nuclear stations will constitute a fourth of the growth factor demanded annually by Britain's expanding industry and population. Lloyd said that within the following decade Britain may be building no new generating capacity other than nuclear.

Serving as a pacemaker for Britain's new program was the experimental work done with prototype reactors by AEA. Shown above at the left is a photograph of a model of Calder Hall, which is now under construction in Cumberland, England. This experimental nuclear generating plant is rated at 50,000 kw. Originally four cooling towers were planned, but now only two (top left) will be constructed. The towers will help to put back into circulation water that is used in the process. One of Calder Hall's two identical reactors is pictured above at the right encased in scaffolding. The piles, which will be in operation soon, will use natural uranium moderated with graphite and will be cooled by carbon dioxide under pressure.

Outlook on Atomic Energy . . . The White Paper reported that atomic power could be generated for about seven-tenths of a cent a kilowatthour, which is still slightly more than the present cost of coal-generated power. However, a number of economic factors have entered into Britain's outlook on the usefulness of atomic energy.

With the price of coal rising, Britain is forced to import coal from dollar areas and her mining force is dwindling. Therefore, Britain estimates that the coal cost will increase and the cost of power generated from nuclear energy will drop. The two prices will cross on the graph, thus making electricity from atomic power economically competitive.

Construction Scheduled . . . The new plan, which is provisional and can be increased or varied when needed, calls for construction of two gas-cooled graphite moderated power stations, each using two reactors, to be started in mid-1957 with operation scheduled for 1960-61. Start of construction of two more plants will take place 18 months later. Basically, they will have the same kind of reactors, but with improved performance. Each of these first eight reactors would have output of 50,000 to 100,000 kw, making total for eight of between 400,000 and 800,000 kw.

Four more stations may be started in 1960, plus another four in 1961-62. Probability is each of these eight stations would have only one reactor. Each station would be more highly rated than predecessors. First four would probably be slightly developed gas-cooled graphite moderated types while last four might be liquid cooled. Total installed capacity of these eight would be well over 1 million kw.

Cost of first two stations, consisting

of four reactors, is expected to be between $84 and $98 million. Next two stations are to cost slightly more while last eight may cost $350 million for the lot. Initial cost of uranium including fabrication of fuel elements is another $112 million while new ancillary plant required in ten-year period might hit $84 million. Concurrent prototype development may cost additional $85 to $112 million, bringing total program cost for ten years to approximately $840 million.

Plutonium . . . It is expected United Kingdom atomic power stations will be producing electricity from equivalent coal saving per year of five to six million tons. Plutonium from early reactors should be available in 1964 at rate of several hundred kilograms per year. Planning target in this program is effectively to extract 3 million kw days from every ton of fuel giving up equivalent heat in 10,000 tons of coal.

If the program goes as expected by 1970 atom power capacity will be 3 million kw by 1975, 10 to 15 million kw. Britain's growth in power capacity requirements over next 20 years is expected to go from some 20 million kw in 1954 to 34-40 million kw in 1956, possibly 55-60 million kw in 1975 with sixth to quarter coming from the atom.

Division of responsibility is that Atomic Energy Authority designs stations, provides general technical know-how, acquires and processes uranium and other fissionables into fuel unit, will take used fuel back for chemical processing. British Electricity Authority will actually place contract with private industry to build electric power stations and BEA will operate same. BEA will buy fuel elements from AEA and trade in used fuel elements on new.

United Kingdom Grid . . . The 275,000-v grid now being built around internal United Kingdom perimeter means that location of plants is no problem as they can be built anywhere safely outside densely populated areas. And yet, power can be easily transmitted to any part of Britain.

Britain isn't expected to be too talkative about its solution of complex atomic power production problems, but instead is holding this know-how in reserve as a big bargaining point when negotiations open with U. S. under relaxed provisions of McMahon Act on exchange of information.

Memphis Has Own Power Plan

Mayor Tobey says city is not bluffing about building steam station to supply its needs. Dixon-Yates group announces it is ready to go ahead with construction of West Memphis plant

As the Dixon-Yates partnership was getting ready to go ahead with immediate construction of a 650,000-kw power plant at West Memphis, Ark., opponents still were making attempts to hamper execution of the controversial power supply contract which would feed private power into the Tennessee Valley Authority area.

In Memphis, Mayor Frank Tobey announced the city would build its own power plant if TVA were unable to supply the city's future power requirements.

And in Washington, Sen Lister Hill (D-Ala.) called for a new investigation of the circumstances surrounding the contract by the Joint Congressional Committee on Atomic Energy. He charged a New York investment banker had participated in Budget Bureau conferences on the contract while his company was making arrangements on the financing of the plant.

But bolstering the validity of the contract was a denial of a petition by Securities and Exchange Commission to reopen hearings on equity financing of the plant approved earlier.

Tobey: We're Not Bluffing

In revealing plans for a municipal plant in Memphis, Mayor Tobey said the city was not bluffing. He declared: "We already have eight financial firms deeply interested in financing us. We wouldn't have the least difficulty in getting the money through a revenue bond issue. These bonds would be paid off with profits from the plant operation. The type steam plant we would be interested in would cost between $75 million and $100 million. It would be nearer to $75 million. The Dixon-Yates project would cost $107 million."

The Memphis mayor said numerous nearby municipalities were interested in having their cities serviced by the proposed Memphis plant. The extent of this, he said, would determine how large a plant the city would build.

TVA now supplies Memphis with 304,000 kw but the city's needs are growing. While the Dixon-Yates contract calls for power from the West Memphis plant to "replace" power TVA now supplies to AEC's atomic energy plants, contract opponents contend the power actually would be used in the Memphis area.

Dixon: It's Okay with Us

Middle South Pres Edgar H. Dixon commented on the Tobey announcement by saying that if the city wished to build its own plant that was its privilege. He added: "We never had any intention of raiding TVA territory. We never had any notion of selling to the city. Our contract is with the Atomic Energy Commission."

Should AEC decide to cancel the contract, Dixon declared power from the West Memphis plant would be absorbed into Middle South and Southern Co systems.

The Dixon-Yates group is now completing arrangements for borrowing $99 million to complete financing of the plant. Dixon announced that "general agreement" had been reached with New York insurance companies and banks on this phase of the financing. He said that Mississippi Valley Generating Co, Dixon-Yates subsidiary, is "just about ready to go ahead" with construction of the plant.

MVGC has completed preliminary engineering, site exploration, soil testing and title searching for the new plant. The new company also has exercised its option to buy a 600-acre site for the steam plant.

In calling for a new investigation of the Dixon-Yates contract, Senator Hill charged in a Senate floor speech that a Budget Bureau memorandum last August purported to lay out complete details on the contract up to that time, but failed to mention that Adolphe H. Wenzell, a First Boston Corp official, had been consulted on financial angles. Budget Director Rowland Hughes confirmed that Wenzell had been retained as a consultant, and said he was listed in the August memorandum with Budget Bureau officials.

NRECA Wants Atom Power

- **Convention urges AEC speed reactor program**
- **Delegates condemn "partnership" policy**
- **Numerous resolutions urge increased federal spending**

ANCHER NELSEN

Atom will aid co-ops when it "makes economic sense."

SEN ALBERT GORE

Government "must point way" by building reactors now.

Federal reactors would provide "atomic energy yardsticks."

CLYDE T. ELLIS

The nation's rural electric cooperatives are pushing to obtain the use of atomic power at the earliest possible moment. This was the keynote theme of National Rural Electric Cooperative Association's 13th annual convention at Atlantic City, Feb. 14-17, attended by 3,800 co-op representatives. The co-ops, according to NRECA's Executive Manager Clyde Ellis, will attempt to achieve the same ends in the atomic energy program "that we have sought and often achieved in the water resources program."

Administration Attacked

In addition to the emphasis on atomic energy, speakers, spearheaded by federal power expansion proponents in Congress, made a Roman Holiday of attacking the Administration and private enterprise on a number of well-worn scores. Heard again and again was condemnation of such things as the Dixon-Yates contract, Hells Canyon development by private power, the revised Atomic Energy Act, "monopolists," and the government's "partnership" policy. The Hoover Task Force on Lending Agencies was condemned for the report it has not yet issued.

The convention wound up by adopting resolutions which, among other things, called for:

- Congressional legislation to prohibit the deduction of private utility advertising costs from income before taxes.
- Appropriation of additional funds for construction of multipurpose hydro projects in various parts of the country, including Passamaquoddy.
- Congress to authorize immediate construction of fuel-powered generating facilities to firm up Missouri River System hydro capacity.
- Federal construction of transmission lines in Southeastern Power Administration's area to tap Clark Hill, Jim Woodruff, and Kerr Dams.
- AEC to cancel Dixon-Yates contract, and Congress to deny appropriations for the contract.
- Congress to repeal legislation permitting accelerated tax amortization.
- Amendment of the REA Act to permit extension of loan repayment periods up to 50 years.

A long resolution on atomic power asks Congress to appropriate funds for an NRECA or REA-NRECA study team, and for funds to permit REA borrowers to participate with NRECA in atomic energy study program. It urges AEC to give increased attention to the development of small reactors adaptable for rural electric systems, and says AEC should abandon "subsidies being granted to private corporations" for reactor development, and should seek federal funds to construct its own reactors.

Under a tongue lashing by North Dakota's Republican Sen William Langer, the Dixon-Yates issue took on such dimensions as to imply the imminent doom of the country. This contract, said Langer, is aimed at "the destruction of TVA, the enlargement of the private power company monopoly, the destruction of the public power movement." Langer claimed that he was warned that "through the manipulations of the Dixon-Yates crowd, I would lose my chairmanship . . . of the anti-monopoly subcommittee of the Judiciary. Well, the Dixon-Yates crowd has won. I am no longer chairman of the committee to investigate monopolies . . ."

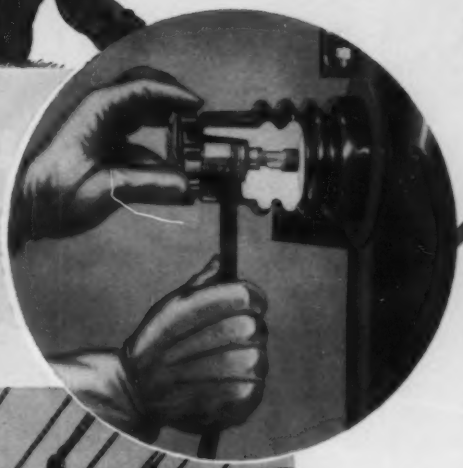
REA's Atom Role

Among the quieter voices was that of REA Administrator Ancher Nelsen who assured the gathering that REA was working closely with AEC in keeping abreast of atomic power developments. "We will take advantage of every development that gives concrete assurance of a lower cost power source that will be dependable and feasible. We are determined that the

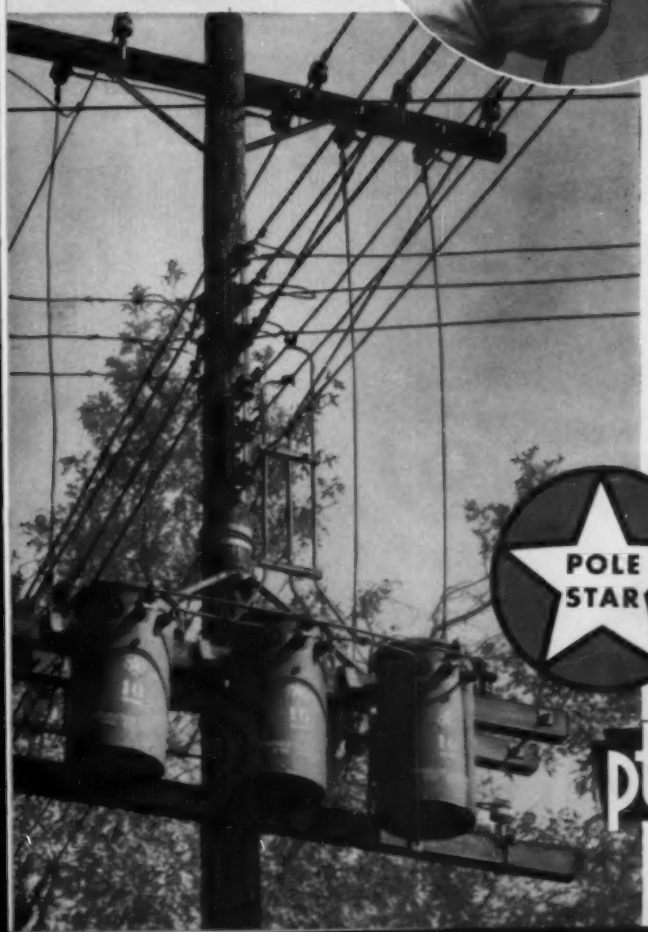
(*Continued on page* 64)

"Hold it, George!

You don't need all that stuff to make a line connection to a "Pole Star"



The Basic Impulse Level of all Pole Star bushings is co-ordinated with the transformer windings. When the transformer is subjected to a voltage surge above the BIL of the bushing, the bushing will flashover on the outside. A separate, completely co-ordinated bushing is available for each voltage class.



If it's a high voltage sidewall bushing, George won't even need a wrench to make a line connection. He can simply insert the incoming cable through the side opening and turn the corrugated easy-to-grip handle. This tightens the pressure block against the cable in a vise-like grip. Most bushings are constructed so that leads can be brought into them from two points 180° apart. The generous-sized handle is constructed of a specially formulated, high dielectric strength, high impact strength, low power factor material. The handle will not break to expose live parts nor chip to cut a lineman's glove.
And George can throw away that X-ray gadget, too. He won't need it because he'll be able to see what he's doing while making line connections up there.

High voltage cover bushings and low voltage sidewall bushings have solderless connectors which are tightened with only a standard wrench to hold line leads securely. All Pole Star bushing terminals are suitable for copper or aluminum cable.

Pennsylvania Transformer Company

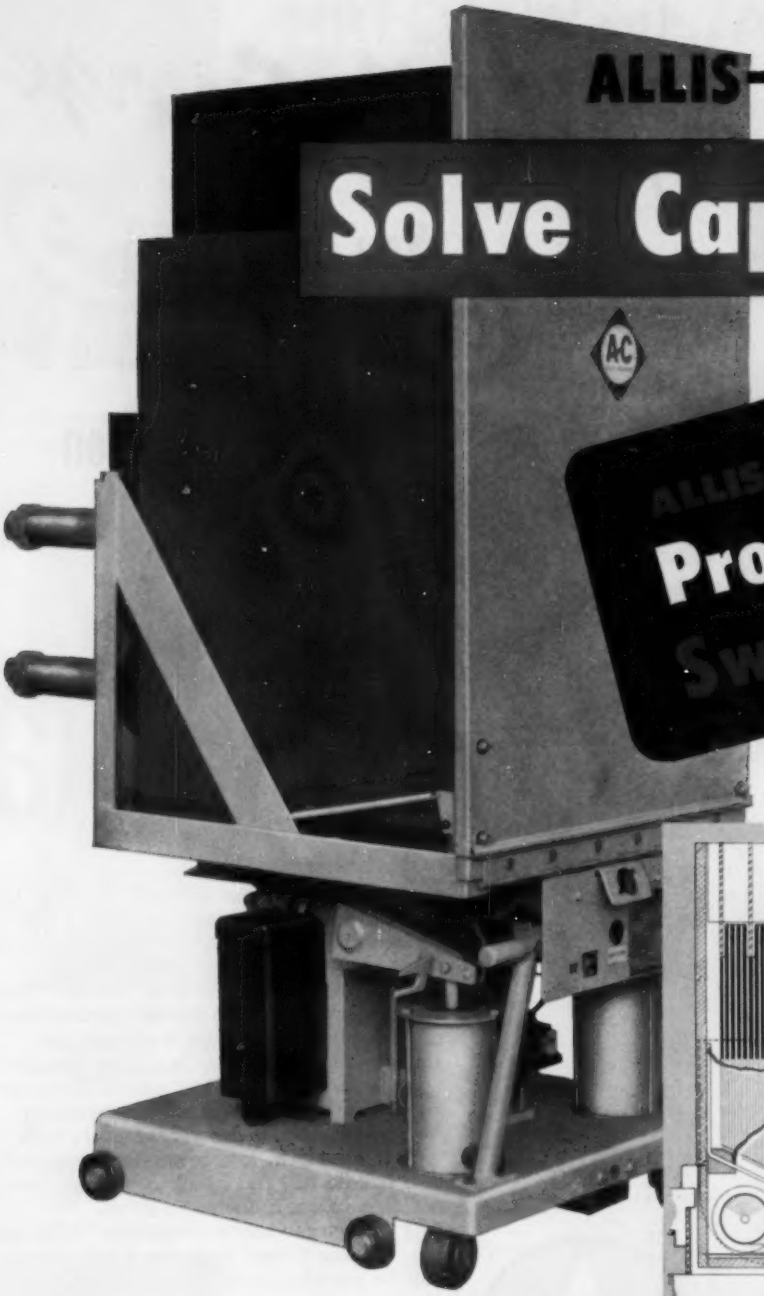
A McGraw Electric Company Division

CANONSBURG • PENNSYLVANIA

Pole Star transformers are available in sizes 3 Kva through 500 Kva and in voltages from 480 through 67,000 volts.

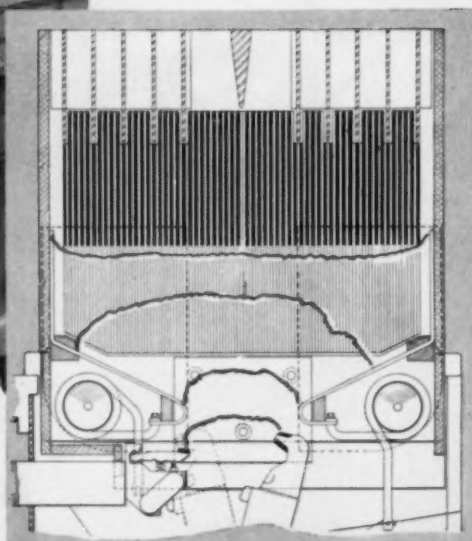
ALLIS-CHALMERS

Solve Capacitor



ALLIS-CHALMERS

Progress in Switchgear



Cross section of contact arrangement shows method of arc interruption.

A-C ALLIS-CHALMERS

ALLIS-

AIR MAGNETIC BREAKERS

Switching Problems

Provide this reliable means of capacitor switching as loads grow and capacitor usage increases

Allis-Chalmers air magnetic breakers are inherently suited to capacitor switching. High arc resistance plus highly efficient puffers combine to insure good interrupting performance over the full current range. Horizontal contact separation also aids breaker operation, since the natural thermal effect assists arc into arc chute.

GET INFORMATION

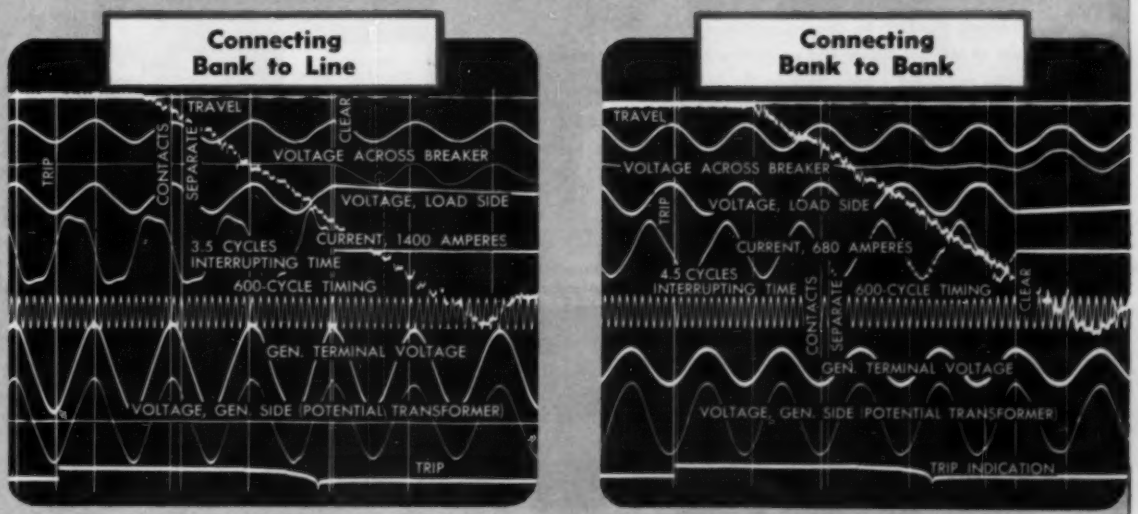
If you are having trouble now with capacitor switching or are planning to add capacitors, ask about Allis-Chalmers metal-clad switchgear utilizing *Ruptair* circuit breakers.

Call your nearby A-C office or write Allis-Chalmers, Milwaukee 1, Wisconsin.

A-4570

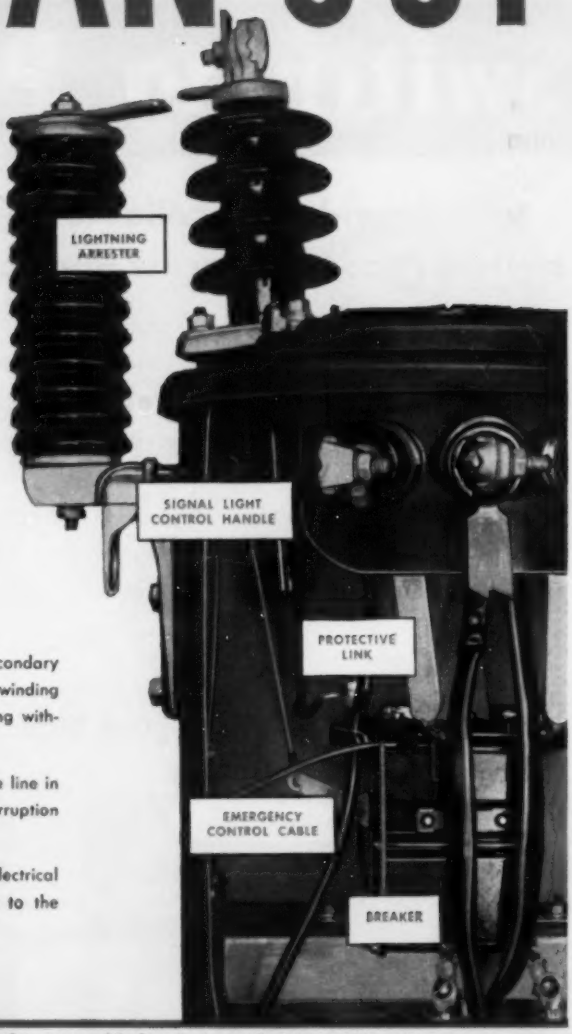
Ruptair is an Allis-Chalmers trademark.

Tests Prove Fast Interruption With Minimum Voltage Disturbance



CHALMERS

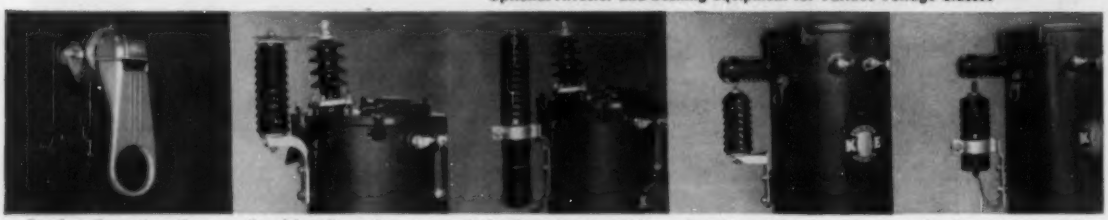
KUHLMAN CSP



Four-way protection gives better service, longer life at lower cost

1. **Protects customer service** by signaling a warning in growing load areas before overloading occurs and providing for emergency overloads.
2. **Protects transformer life** by providing a secondary breaker that operates within the safe limits of the winding temperature and protects against unsafe overloading without sacrificing short-time overload capacity.
3. **Protects the line** by clearing transformer from the line in case of internal failure and preventing service interruption to the remaining transformers on the line.
4. **Protects against lightning** by safely bypassing electrical surges without interruption of service or damage to the transformer.

Optional Arrester and Bushing Equipment for Various Voltage Classes



Breaker Operating Handle with Warning Light and Emergency Control Lever.

Expulsion Type Arrester with Isolating Gap.

Valve Type Arrester with Isolating Gap.

Expulsion Type Arrester with Isolating Gap.

Valve Type Arrester with Isolating Gap.

Voltages above 5,000 Volts Mountings Are Interchangeable.

Voltages Below 5,000 Volts Mountings Are Interchangeable

165

KUHLMAN ELECTRIC COMPANY, BAY CITY, MICHIGAN • CRYSTAL SPRINGS, MISSISSIPPI • SALINAS, CALIFORNIA

PA's and Suppliers Look at Prices

Instability of charges for heavy items and cutthroat competition arouse concern. Copper supply is not predictable, but aluminum and steel are plentiful

Prices of key items of electrical equipment occupied the attention of utility purchasing agents during formal and informal sessions of the annual mid-winter conference of the Public Utility Buyers Group of the National Association of Purchasing Agents. Nearly 800 purchasing agents and suppliers were registered for the group's 24th annual meeting held Feb. 13-15 at Houston.

The utility buyers were plainly disturbed over the instability of prices on heavy items during the weeks preceding the meeting. Most forceful comment came from David Williams, manager, construction contract and equipment bureau, Consolidated Edison Co of New York. He told listeners at the final session, "We must condemn in the strongest terms the cutthroat competition that has recently taken place in the industry."

"By the same token we also condemn the unsound pricing policies which have resulted in the high price levels on some items."

Other speakers voiced concern that recent markdowns on equipment might sharply curtail services and extras that have enabled electric utilities to secure thoroughly modern and reliable equipment. In off-floor discussion, purchasing agents indicated that the instability of prices makes it difficult, if not impossible, to study thoroughly and compare price and quality advantages of equipment.

Also relating to the price situation were appraisals of primary metal markets given by representatives of producers. Speakers indicated that the future supply of copper is not clearly predictable because of the uncertain attitude of the Chilean government and labor strife in Rhodesia.

On the other hand, aluminum was reported to be in good supply. Fulfillment of stockpiling requirements on aluminum makes the outlook even brighter. Steel, too, will be in good supply, the buyers were told.

J. Donald Hogg, purchasing agent, Cleveland Electric Illuminating Co, presented a study of the pros and cons of leasing automotive equipment for utility use. He discussed the comparative advantages in terms of cost of ownership, operation, and maintenance and income tax requirements.

J. N. Landis, vice president, Bechtel Corp, San Francisco, speaking as if this were 1960, gave purchasing agents a look at problems they may expect in connection with the development of nuclear power plants.

A discussion panel on prices, escalation clauses, and progressive payments gave purchasing agents an opportunity to exchange views with manufacturers. Abstracts of the views of the five panelists follow:

There are two sides to every story

PA's had this to say...

David Williams

Manager, Construction Contracts & Equipment Purchases, Consolidated Edison Co of New York

"We must condemn cut-throat competition . . . and also condemn unsound pricing policies which have resulted in the high price levels on some items."

We must condemn in the strongest terms the cutthroat competition that has recently taken place in the industry. By the same token we must also condemn the unsound pricing policies which have resulted in the abnormally high price levels on some items.

Purchasing agents cannot ignore the inflationary effects of the current "managed economy" policies which include farm price supports, stockpiling, foreign aid, and managed currency.

While suppliers countered with...

R. G. Wheaton

Vice President, Marketing and Sales, Line Material Co

"We have ample evidence of vigorous and varied competition in our industry."

In my opinion price and competition go hand in hand. Prices depend on a multitude of factors and represent the figures at which items can be sold under competitive market conditions. With the inception of a new product, the price may temporarily reflect costs plus an arbitrary profit. This situation, however, disappears as soon as competitive factors have a chance to come into play. We have ample evidence of vigorous and varied competition in our industry.

Lower prices are to be desired but not at the sacrifice

Williams continued . . .

Nevertheless, it must also be recognized that governmental agencies are not solely responsible for the present abnormally high price level. Suppliers have in many instances forced prices higher than was warranted by increases in either labor or material.

Where governmental aid could not be invoked to maintain prices at the peak, they have declined at a faster rate than prices which have had more modest increases.

While prices in general were frozen during World War II, the removal of price controls following the end of the war initiated a startling price increase.

It is apparent that the greatest price increases have occurred in those items that have built-in price rigidities; whereas the lowest increases have taken place in those items that are subject to the restraining influence of competition. In the current buyers' market, a more realistic appraisal of current prices by suppliers is warranted.

R. C. Wenz

General Purchasing Agent, Duquesne Light Co

"I find a uniform opinion that present escalation terms are too arbitrary and therefore no longer acceptable."

Public utility purchasing agents, and no doubt all purchasing agents, are opposed to escalation of prices as now proposed by some manufacturers.

Some of the objections to the usual escalation clauses are:

1. The amount and timing of price changes are solely under the control of the seller, and such changes are not always related to cost changes.
2. Even when costs at time of shipment are admittedly higher than those prevailing when the order was booked, it does not seem fair to apply the entire increase to the total order because only a portion of the labor and material cost may have been subjected to higher costs.
3. The buyer whose duty it is to approve price increases under escalation finds it almost impossible to check especially priced items.

A purchasing agent who spends his company's money under these conditions should resist escalation to avoid paying out money that he is not sure is due. We assume that prices quoted today at 200% over 1946 level have taken into account all known price factors, including possibility of future price increases. When the seller submits a quotation on this basis and then introduces escalation terms, he is in effect asking the buyer to pay what might be considered a very healthy price and still assume the seller's risk for any subsequent price increases.

In a survey of public utility buyer opinion I find a uniform opinion that present escalation terms are too arbitrary and therefore no longer acceptable. Where escalation is necessary, a formula should be considered.

Wheaton continued . . .

of adequate quality or service. To be worthy of consideration, lower prices should spring from creative ingenuity and better use of facilities. Cutting prices maliciously just to injure other suppliers is not true competition.

From time to time the comment is heard that competition is dead. Such statements are usually aimed at market situations where uniform prices exist. It is logical to expect that in a free, fully informed market, like items will sell for the same price. Every supplier devotes a tremendous amount of effort in keeping closely and effectively informed of the activity of his competition. Competent purchasers extend themselves in the same fashion and are thoroughly abreast of market events.

As a market reaches a perfect state with both parties completely informed of all facts involved, a uniform price structure is inevitable.

As standards for material and equipment become more prevalent and generally recognized within an industry, the greater the trend toward uniform prices.

Even under such conditions there is invariably keen, competitive activity as far as quality and service are concerned. In fact, these values amount to a price cut.

As far as prices are concerned, we have much to fear from artificial, external influences that spot our economy from time to time. These interfere with the normal competitive process. When into each renewed labor contract up-scaled wage rates are written, not accompanied by increased production or greater efficiency, prices are pushed in the only direction they can go—up. Competitiveness tends to be throttled. When government edicts limit the free, natural flow of certain materials, competition likewise declines.

If one is accustomed to buying from a certain source, it often takes considerable inducement in quality, price, or service to change the habit. The buyer should maintain an open mind and be ready to recognize the best offers of quality, service, and price.

C. V. Roseberry

Manager, Electric Utility and Transportation Sales Department, Westinghouse Electric Corp

". . . electrical apparatus price increases have not kept pace with manufacturer's basic cost increases."

On lines of apparatus where one year or longer is required to complete shipment, escalation is reasonable and fair. Such an arrangement enables the purchaser to procure equipment at the lowest possible price and the supplier to make a fair and reasonable profit. The risk to both parties is reduced to a minimum.

The trend in prices of electrical apparatus over the past few years, developed under current electrical equipment industry price policies, clearly demonstrates that the price of electrical apparatus under current escalation

Wenz continued . . .

We believe that equipment quoted for delivery for 12 months or less should be on a firm price basis, that any escalation terms on equipment taking more than one year to manufacture should be on a formula basis.

J. B. Homsher

Manager, Purchasing Department, Gilbert Associates, Inc

"If the utility is agreeable to making progressive payments, they should be given a price advantage . . ."

The manufacturers of major equipment have for some time been asking for progress payments to cover purchases of major equipment. Some manufacturers base their progress payments on manufacturing cycles and others on a dollar value.

By making advance payments, the utility is providing working capital for the manufacturers who, in the past, have provided their own. I do not think the manufacturer is aware of the problems that many utilities encounter in complying with their request.

It costs money to provide working capital and as purchasing agents, we should analyze the cost to be sure that working capital is being provided in the most economical manner.

I have contacted 19 utilities. Eight state they have made no progressive payments on any major equipment. Nine have made progressive payments. Three of the nine made progressive payments on turbine-generators only. Three of the utilities who made progressive payments received a price reduction. Two state that they execute contracts on a negotiable basis.

Seventeen utilities made a definite statement that their managements do not like progressive payments.

After reviewing this, I definitely find there is no consistency although the manufacturers have a definite publicized method and even submit this method on preprinted sheets inserted under "General Conditions". I have seen proposals recently where terms have been deleted in the contract and inserted is "See Letter Attached", which merely states that terms will be negotiated.

In talking to many of the manufacturers' representatives, they all state that if you are in the market they are willing to negotiate.

It should be entirely up to each individual purchaser as to how he wishes to settle the terms on a contract covering major equipment. The utility may be in a position to make progressive payments, or it may not. The financial position may be such that it will be advantageous to make progressive payments. If the utility is agreeable to making progressive payments, it should be given a price advantage to cover the interest on the money financed because it is furnishing working capital for the manufacturer at no cost.

Roseberry continued . . .

policies has not increased as fast as other comparable products (see chart below).

There also is evidence that electrical apparatus price increases have not kept pace with manufacturer's basic cost increases and that the economies realized through

improved methods and modernization have been passed on to the purchaser (see chart below).

If the amount of escalation had been determined by applying a formula (55% of contract price considered labor, 35% material) the price of electrical machinery would have risen much more than it did. Using this formula, one similar to the pricing clause previously used by the electrical industry, it would appear that the price policy applied in the recent past has been reasonable. This type of escalation definitely provides the purchaser a form of protection in establishing the maximum liability under each particular contract.

Many different types of formulas and indices could be used. With the broad line of products manufactured by the electrical industry, the problem of administration becomes complex and expensive for both the buyer and seller. There seems to be little continuity of thought among purchasers as to what is desired or what is reasonable should formula-type escalation be considered.

Heavy Equipment Market Firms Up

- **Price "zoom down" was biggest to hit the heavy equipment items in decades**
- **Power transformers, capacitors were at the center of the break**
- **Prices are now stabilizing at or near November, 1954, levels**

Prices on key items of heavy electrical equipment are stabilizing following one of the biggest breaks of the equipment market in decades.

Recent reports indicate that orders for smaller power transformers have recently been placed at or very near list. Even on larger power transformers, there have been several orders placed at prices ranging from 10% to 20% below book prices. These discounts are small compared with ones offered January.

Electric utilities report equipment prices are pushing up near November, 1954, levels after competitive price cutting that has ranged up to 50% on some lines of heavy equipment. While it is impossible to gauge the volume of orders placed by utilities during the six weeks ended in mid-February, reliable sources indicate that the volume has been extremely heavy.

Price cutting appears to have centered on power transformers, although it may have started on capacitators. It quickly spread to include most heavy equipment. Capacitors and other switchgear items have been particularly hard hit. Even aluminum conductor has felt ripples from the price zoom down. However, some items have held fairly firm. Among them are distribution transformers, insulators, and most shelf items.

Manufacturers have called off a 6% increase in watthour meter prices. Increases on insulators and some pole line items put into effect late last year are understood to have held despite the heavy price cutting in other areas. In the case of insulators, freight costs have been the main reasons for increases.

Sellers, Buyers Disturbed

It is almost impossible to determine when or how the price cutting started, but apparently some trimming started before the first of the year. By the time the spiraling cuts had reached a frantic stage in January both buyers and sellers were in a state of mild panic. Purchasing agents and others responsible for procuring utility equipment had no time to study and evaluate the price and quality advantages of various offers during the price cutting spree. In a few cases orders which were placed to take advantages of the cuts have been cancelled.

In manufacturing circles, the talk is guarded. It is apparent, however, that some of the orders placed will mean losses to manufacturers. It is almost certain that the short, prices will bring proportional trimming of services, research, and post-purchase maintenance. The "extras" will have to be trimmed in the opinion of some utility and manufacturing men.

A sampling of opinion among participants of the recent mid-winter conference of the Public Utility Buyers' Group meeting in Houston indicated a very wary attitude toward the price cutting both on the parts of buyers, and sellers. One utility spokesman told members, "We must condemn in the strongest terms the cutthroat competition that has recently taken place in the industry." Most buyers, while worried, appeared to take a less extreme view. But they made it clear that the widely fluctuating prices added considerably to their responsibilities.

It is known for certain that not all utilities took advantage of the price drops during the six-week period. Either because they were not fully prepared to buy during the period or because they were wary of the situation, they held off. Buyers on the outside do not appear particularly disturbed, although they accept the proposition that the period of the deep cuts is passed.

What Caused the Break?

Nobody is able to put a finger on the cause of the biggest price break in decades. Most manufacturers affected by the drop were producing at high levels during most of last year and industry forecasts indicate no notable cutback in utility construction during the current year. While generation expansion may have to be stepped up above present plans.

Actually slight increased spending is planned in the transmission and distribution fields this year over last.

Utility buyers lean toward the belief that the price slashing was started in a small way as an incentive to get future orders on the books. But the test cuts grew into quickly spiraling slashes that made hash of list and book prices. General view is that manufacturers and suppliers were willing to sink huge sums in jockeying for position in the highly competitive market.

Improved manufacturing efficiencies may have made possible some price trimming, but no one claims these efficiencies are anywhere near the order of the prices quoted in recent weeks. While it is widely known that manufacturers are set on holding on to their present skilled workers and putting new production facilities to full use, it is not plausible to believe these are the sole reasons for the price drops.

All these factors taken together could explain the slashes, although taken separately they are not impressive.

It is generally believed in the industry that the big price slashes are at an end. It is probable, though, that consideration will be given to utilities who will order well in advance of needs. Men close to the situation admit there is no obvious economic reason for the drops. They think prices are already finding their levels very near those which existed before the frenzied period of the past six weeks. It will still be a buyers' market, but it will be a long time before price dips are as extreme as they have been in recent weeks.

DEAD-ENDING ALUMINUM

is an old story with us . . .

With the advent of the aluminum conductor and its growing acceptance and use during the past few years, we here at Pinco have kept abreast of this gradual change from copper to aluminum conductors by designing our products to meet both present and future industry requirements. Typical of these, are the three new Pinco Strain Clamps shown here which are designed to accommodate either ACSR or All Aluminum in distribution construction.

Yes, we are experienced hands when it comes to clamping aluminum and out of experience such as this, have come the many Pinco products which have been serving the electrical industry faithfully for *thirty-three years*. So if you have a problem, related to clamping aluminum conductor on your distribution and transmission lines, we invite you to PUT IT UP TO PINCO.

FEATURES

- Easy to blanket when working lines "hot"
- Excellent snubbing action, making them "easy" on the conductor.
- "Come-along" eye provided in all three clamps for easy installation of conductor.
- Quadrant type design allows continuous "running" of conductor—eliminates necessity of cutting the conductor at strain points to make "jumper" loops.
- Constructed of highest grade malleable iron, properly annealed and normalized, then hot-dip galvanized.
- Steel U-Bolts and Cotter Bolts, hot-dip galvanized. Spring Brass Cotter Keys.

PINCO 4550
Will accommodate All Aluminum conductors and ACSR from .2 to .55, including No. 4 through No. 1/0 ASCR or All Aluminum.

PINCO 4468
Designed for use with 2/0 through 4/0 ACSR or All Aluminum conductors ranging from .2 to .69.

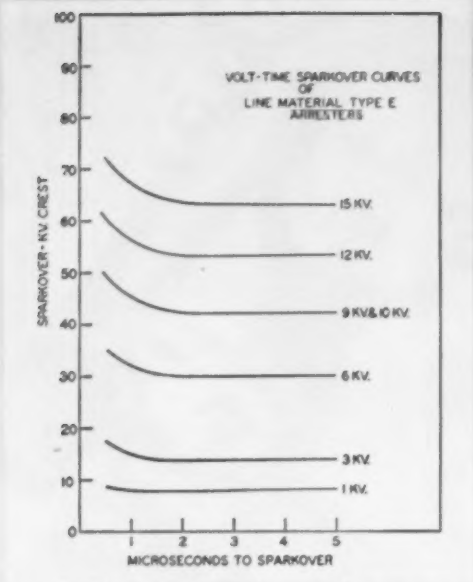
PINCO 4485
Recommended for use on 226,800 C.M., 300,000 C.M. and 336,400 C.M. ACSR or All Aluminum.

All three clamps can be used for smaller conductors where a wide range is desired. Liners furnished if required.

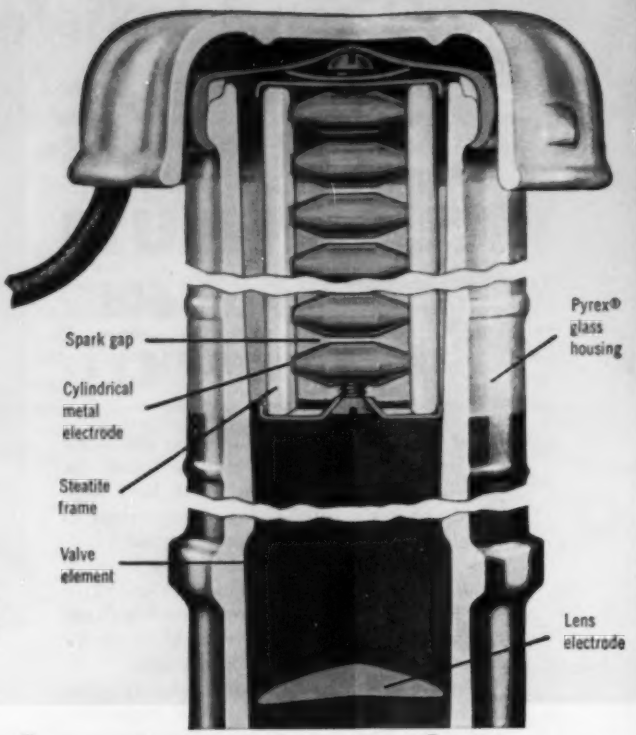
PINCO INSULATORS
RIGHT ON THE JOB

The Porcelain Insulator Corporation
LIMA, NEW YORK

Sample Strain Clamps Gladly Furnished on Request



Volt-time curves of arrester sparkover on impulse. These curves illustrate the quick response of the arrester to lightning surges. At all points of the curve the impulse sparkover of the arrester is far below the insulation strength of the distribution equipment being protected.



How L-M's Type E Valve Arrester Balances 60-Cycle Sparkover and Impulse Sparkover

By **GEORGE W. COOPER**
Manager
Protective Equipment Sales
Line Material Company

L-M's Valve Arrester spark gap is designed to prevent unnecessary 60-cycle sparkover of the arrester to harmless switching surges, whereas the low and consistent impulse sparkover brings the arrester into operation quickly and dependably in case of a dangerous lightning surge.

Precision Spark Gap

The spark gap is made of electrode members, accurately spaced and supported by a strong machined frame of high-grade steatite. The gap is so designed that its 60-cycle sparkover value is approximately 1.8 times the rating of the arrester under wet conditions. This is sufficient to keep normal switching surges from sparking over, and provides a path to drain off higher switching and lightning surges.

At higher surge voltages the combination of the metal electrode and the steatite produces an instantaneously ionized, electrically fast path. This combination, together with the cylindrical design of the electrodes, forms a ladder gap unit with a low impulse sparkover.

High Discharge Capacity

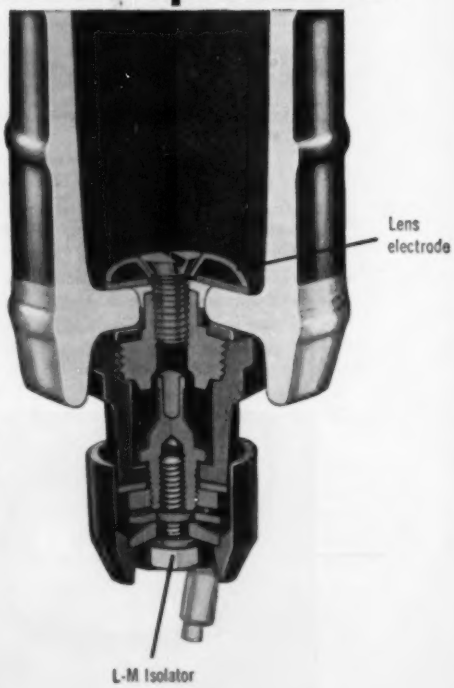
L-M's exclusive bonded valve element combines low IR drop with more than enough capacity to handle the 65,000-ampere surges prescribed by NEMA. It acts as a valve to limit power follow current to a negligible value.

The result of all these features is that the L-M Type E arrester is outstanding in the protection it provides, in its long life under severe lightning conditions, and in its permanent, never-changing characteristics. L-M valve-type arresters amply meet all NEMA standards.

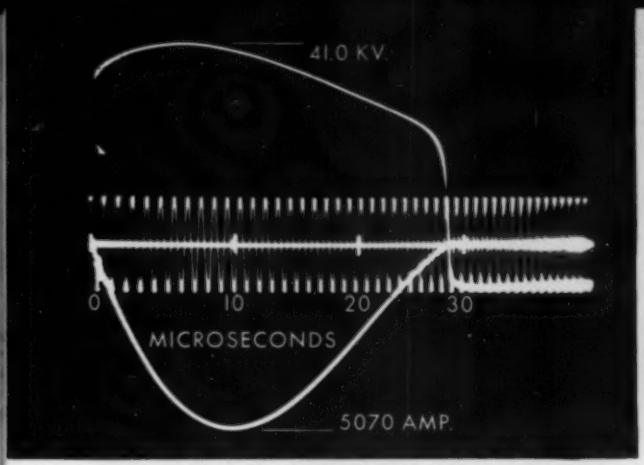
In addition, L-M's "ISOLATOR" provides positive assurance against grounding feeders, by disconnecting the ground lead from the arrester, if the arrester should ever become damaged.

Get This Bulletin

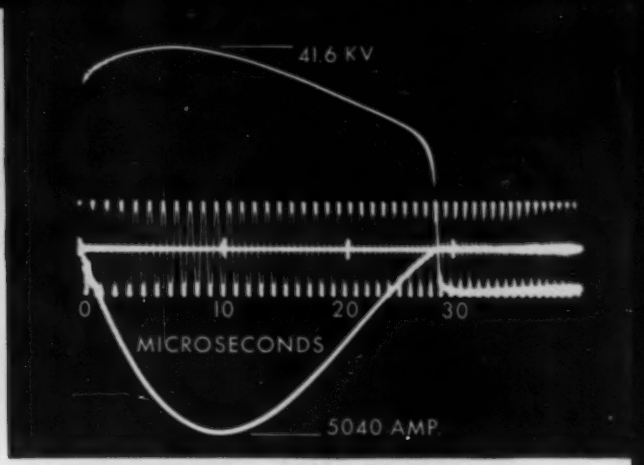
Get the whole story of L-M arrester performance and application. Ask the L-M Field Engineer for a copy of Bulletin LA2; or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).



LINE MATERIAL Lightning Arresters



Before test: Oscillogram illustrates the electrical characteristics of an L-M 9 kv arrester before the AIEE Operating Duty Cycle Test of thirty operations using a 5000 ampere surge and 60-cycle follow current at the rated voltage of the arrester.



After test: Oscillogram of electrical characteristics of the same arrester after AIEE Operating Duty Cycle Test, illustrating the unchanging high degree of protection that is maintained throughout the life of the arrester.

How L-M's Type E Valve Arrester Provides Low IR Drop, High Discharge Capacity

By **GEORGE W. COOPER**
Manager
Protective Equipment Sales
Line Material Company

L-M's exclusive design of valve arresters provides the optimum amount of valve material to give balanced performance. The valve material must provide a low impedance path for surge currents to assure low IR drop, provide ample surge current capacity, and function as a valve to limit follow current until it is interrupted by the series gap.

Several factors contribute to the high discharge capacity or ability of the Type E arrester to handle heavy strokes of lightning without damage.

L-M's Molded-in Valve Element

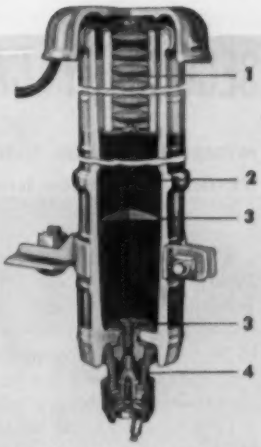
"Granulon," the valve material, was developed as the result of years of experience and research in distribution-type arresters. It is able to withstand severe heating which accompanies heavy strokes of lightning. The "Granulon" is mixed with a special non-charring, inorganic, glass-like binder; then molded directly into the glass housing at high pressure to form a hard, dense mass with outstanding discharge capacity and valve-action properties.

Lens-shaped electrodes are placed in the valve element to counteract the lightning surge current "skin effect." These electrodes have been scientifically designed to produce a multiple-path distribution of the surge current throughout the valve element, thus increasing the discharge capacity of the element and assuring long, uniform life.

Assures High Capacity

The characteristics of L-M's valve element combine optimum performance features with outstanding protection and long arrester life. These characteristics are retained permanently without change caused by aging or service.

In addition, the "Isolator" provides positive assurance against permanent fault to ground by disconnecting the ground lead from the arrester if the arrester should ever become damaged.



1. The ladder spark gap is designed to provide a perfect balance between 60-cycle sparkover and impulse sparkover.

2. "Granulon," the valve material, is able to withstand severe heating which accompanies heavy strokes of lightning.

3. Lens-shaped electrodes in the element counteract "skin effect" of surges, assuring even distribution of the discharge throughout the valve element.

4. L-M's "Isolator" gives positive assurance against grounding feeders by disconnecting the ground lead from the arrester if the arrester should ever become damaged.

Electrical Characteristics of Type E Valve Arrester

KV Rating	Minimum Impulse Sparkover 1½ x40 Wave KV Crest	Front of Wave Sparkover KV Crest	IR Drop Across Arrester				
			1500 Ampere Surge	3000 Ampere Surge	5000 Ampere Surge	10,000 Ampere Surge	20,000 Ampere Surge
1	8	8	4 KV	4.5 KV	5 KV	6 KV	7 KV
3	14	17	11 KV	13 KV	14 KV	16 KV	18 KV
6	30	33	22 KV	25 KV	27 KV	31 KV	35 KV
9	42	49	33 KV	37 KV	41 KV	46 KV	53 KV
10	42	49	37 KV	42 KV	46 KV	52 KV	59 KV
12	53	60	44 KV	49 KV	54 KV	60 KV	67 KV
15	63	70	55 KV	62 KV	66 KV	74 KV	85 KV

(On wave rising 100 kv per microsecond per 12 kv arrester rating; 10 kv per microsecond for 1 kv arrester.)

Get the whole story of L-M arrester performance and application. Ask the L-M Field Engineer, or write for a copy of Bulletin LA2, Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

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LINE MATERIAL Lightning Arresters

AIR CONDITIONING LOADS in downtown Toledo buildings prompted installation of secondary capacitors in basements of those buildings

BASEMENT LOCATIONS for secondary capacitors were found to afford maximum benefits to the system, including improved network voltage

SECONDARY CAPACITORS PUT IN CUSTOMERS' BASEMENTS

FREDERICK R. MILLER, Senior Assistant Engineer,

WENDELL A. JOHNSON, Senior Assistant Engineer, Toledo Edison Co., Toledo, Ohio

Results obtained with five secondary capacitors on customers' premises on the network system have prompted Toledo Edison Co to select more locations for such installations in preparation for the next air conditioning season. In this study the utility installed two 90-kvar and three 45-kvar units in downtown Toledo in buildings with low power factor air conditioning loads.

In general, two types of locations were studied: Transformer vaults and customers' service entrances on the network. The latter, it was found, afforded the maximum benefits to the system although such installations involved obtaining space on a customer's property. Benefits obtainable from capacitor installations are:

1. Reduced kva loads on all parts of the system up to and including the secondaries.

2. Reduced losses in all components of the system up to the capacitor installation.

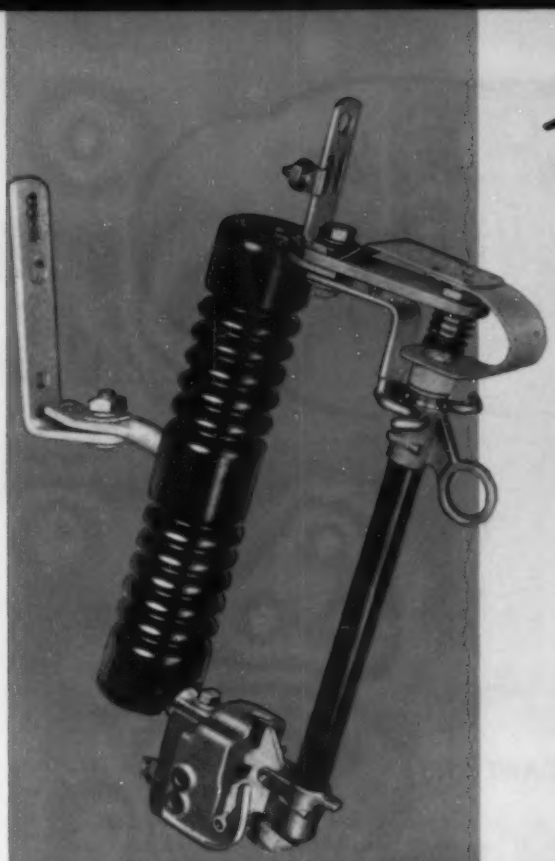
3. Improved voltage on the network secondary, especially with a transformer out of service.

The accompanying table compares the advantages and costs of a 90-kvar capacitor installation in a vault with a similar one at a service entrance, the load on each being 128 kva at 0.75 pf. A capacitor unit apparently too large for the application was used in the basement installation with a view to future air conditioning loads in the building. The service entrance installation not only provided all the benefits derived from the transformer vault installation but reduced load and losses on the network secondary and service cables. Connecting the capacitor in the line side of the customer's switch resulted in no change in his switch and distribution requirements.

Fused capacitor units of 45 and 90-kvar, 230-v ratings are rated 40 and 80 kvar, respectively, when installed on 208 v. The units selected were dustproof and equipped with fused safety switches.

Table—Vault and Basement Capacitor Installations Compared

Capacitors Installed	0-*Kvar*	80 *Kvar In Vault*	80 *Kvar At Service*
Load on Transformer After Capacitor Installation			
Kva	128	96.2	96.2
Kw	96	96	96
Kvar	85	5	5
Power factor	0.75	0.998	0.998
Cost For Serving 96-kw Load			
Transformers, vaults and primary cable-$70/load kva	$8,960	$6,734	$6,734
Secondary and service cables-$30/load kva	3,840	3,840	2,880
Capacitors installed	0	2,200	1,975
Total	$12,800	$12,774	$11,599
Savings	0	$26	$1,201



New Easy Way to select cutouts

S&C's new XS Cutout carries short circuit interrupting ratings on a symmetrical basis, greatly simplifying calculations needed for cutout application. Predicated on known circuit characteristics, the symmetrical ratings match performance requirements at protection points.

Type XS Cutouts interrupt 4000 amp symmetrical (7.5 kv) and 3300 amp symmetrical (15 kv) at (1) sectionalizing points on distribution feeders, (2) distribution transformers, and (3) pole top capacitor banks . . . where the X/R ratio to the point of the fault is 4 or less. Cutout selection thus becomes direct and positive . . . conversion of fault currents from known symmetrical value to elaborately calculated asymmetrical values is no longer required.

Note that these ratings, which equal heavy-duty cutout performance, come at standard-duty cutout cost. It will pay you to obtain complete information on the Type XS Cutout contained in S&C's new Catalog Section 511.

Amperes, RMS		
Cutout Voltage Rating Kv	Asymmetrical Latest NEMA Std.	Symmetrical Alternate Suggested Std.
7.5	5000	4000
15	4000	3300

NEW SYMMETRICAL RATINGS SAVE TEDIOUS CALCULATIONS

S&C ELECTRIC COMPANY

4421 RAVENSWOOD AVENUE
CHICAGO 40, ILLINOIS, U. S. A.

IN CANADA:
S & C ELECTRIC CANADA, LTD.
8 Vansco Road, Toronto 14, Ontario

POWER FUSES • DISTRIBUTION CUTOUTS AND FUSE LINKS • LOAD INTERRUPTERS • METALCLAD SWITCHGEAR

Specialists in High-Voltage Circuit Interruption

No matter how you buy 'em you know it's RIGHT when you specify CHANCE!

IN BUNDLES

IN CARTONS

There are advantages either way you buy expanding anchors. If you stack them outside or in stock bins you probably want them in bundles. If you stack them on shelves or on the warehouse floor, cartons will likely be more convenient.

It depends too on how you want your anchors identified. All Chance 8-Ways are stamped with the catalog number and make. Bundles are tagged for easier identification in stock. These tags show rod size and area plus the catalog number. Chance anchor cartons have this information printed on the side and end of the carton.

Packaged 8-Ways come 3, 6 or 12 anchors to the carton, depending on anchor size. Bundled 8-Ways are wired together in convenient bundles of 2, 3 or 5 anchors, depending on size.

But *any way you get the 8-Way*—you get the expanding anchor that pushes *eight* blades into undisturbed earth all around the hole, with no wasted space between blades. This means complete, balanced load distribution.

The Important Thing is what goes on below "see level"

play it safe—Give the GUY a CHANCE!

ABC INDUSTRIES

A·B·CHANCE CO·

CENTRALIA, MISSOURI
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CA59-1

Doble Warns of Crisis In Insulating Oil

FRANK C. DOBLE QUIZZES OIL EXPERTS E. F. Walsh, New England Power; E. L. Raab, General Electric; Walter White, Esso Standard Oil; and Dr Gilbert Thiessen, Koppers Co

Impending abandonment of conventional sulphuric-acid refining will leave utilities and manufacturers without suitable insulating oils. Refiners do not know how to make good insulating oil by the solvent process. And requirements become more critical as new design techniques subject oil to higher temperature and voltage stresses, smaller oil ducts, and forced circulation.

This warning was sounded by Frank C. Doble, president, Doble Engineering Co, at the 22nd annual Doble Client Conference, Jan. 24-28, at Boston. It was supported by a panel comprised of E. L. Raab, General Electric Co; Walter White, Esso Standard Oil Co; and Dr Gilbert Thiessen, Koppers Co.

Urges New Specifications . . . Doble urged stepped-up efforts to devise specifications for insulating oils to procure the qualities essential to satisfactory performance. Removal of corrosive compounds by acid refining also reduces natural inhibitors, Doble said. Refiners should hold acid to the minimum for satisfactory elimination of the corrosives. Test methods are available to measure this achievement.

Today's transformers work oil harder thermally but impose less exposure to oxidation, noted E. L. Raab. New oils must be economically desirable, available from several crudes and well-dispersed refineries, and less sensitive to contamination than present oils. He endorsed Doble's testing proposals, predicting that accelerated testing could evaluate performance life of any new oils in 6 to 24 months.

Refiners, Chemists Collaborate . . . The trend away from acid treatment was confirmed by Walter White. He conceded that refiners have yet to find an acceptable combination of new refining method and crude to produce satisfactory insulating oil. But some new oils pass laboratory tests when a small quantity of inhibitor is added. If this meets requirements, then savings by the new refining process may justify the cost of adding inhibitor. He favors cooperation between refiners and oil users to develop new guides for insulating oils.

Inhibitor manufacturers should not influence oil development, said Dr Thiessen, but should supply the proper inhibitor. Such an additive must be harmless to transformer materials in its original state and after oxidation. The purity of highly refined insulating oil does not guarantee stability, he said. New tests for quality must be correlated with service experience.

Wet Insulation Cured . . . Removal of moisture from insulation in oil-immersed apparatus remains a critical problem in preventive maintenance, reported P. L. Bellaschi, consulting engineer. Most cellulosic materials absorb 8 to 10% moisture by weight from the atmosphere. But modern techniques of heat, vacuum, and activated alumina have demonstrated ability to cut residual moisture to less than 0.1%. This contributes to low insulation power factor and long service life.

Moisture content of a transformer can be determined in the field by pumping vacuum on the tank, reported R. L. Murray, Alabama Power Co. The lowest absolute pressure attained approximates the vapor pressure, whence an equilibrium chart for the corresponding oil temperature determines moisture content of the insulation.

Sealed transformers are expected to be free from moisture. But one 100-kva, 6,900-v, 3-ph unit was found to have high insulation power factor. A leaking gasket permitted the transformer to breath moisture-laden air, reported J. E. Housley, Alcoa.

Bushing Leak Causes Failure . . . Ren Beatty, Union Electric Co of Missouri, described a 34.5 kv bushing failure on a 100,000-kva transformer following moisture condensation and an unsealed flange gasket. The need of better methods of determining whether the bushing is filled with oil was stressed. J. A. Mahan, Ohio Power Co, advocated power factor testing to check 15-kv bushing seals; trouble with new equipment guided this practice.

Gratifying comments were voiced at recent progress in bushing designs facilitating interchangeability. E. V. De Blieux, General Electric, stated that glass shell bushings will be used in some 34-kv transformers this year to obtain service experience.

J. H. Frakes, Westinghouse Electric Corp, advised that a new bushing manual will soon be available, that power-factor testing is now standard

(*Continued on page* 27)

here's where insulators come to life

Useful insulator life starts with "clipping-in." Performance is evaluated from this time on. As time passes, the insulator quality (or lack of it) becomes apparent.

Well over 30 years ago transmission conductors were clipped-in to O-B cap-and-pin suspension insulators, basically similar to those shown here on a 330-kv structure. Where those lines are still in service, those insulators are still in use.

Younger O-B units are establishing similar records just as fast as time permits!

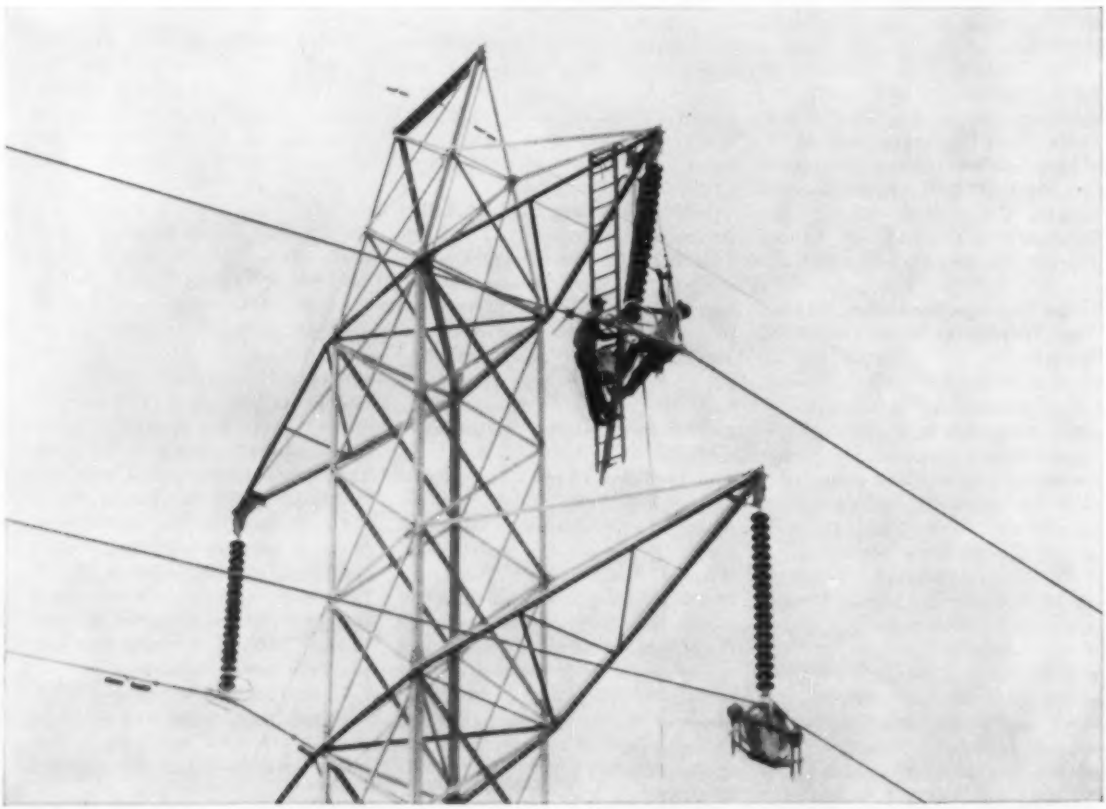
Because this sort of O-B performance is a matter of record throughout the power utilities industry, O-B insulators have been chosen for every extra-high voltage transmission system now operating or under construction anywhere in the Americas!

OHIO BRASS COMPANY • MANSFIELD, OHIO

Builders of this 330-kv line could not select insulators and allied hardware at random, allowing an uncertain future performance pattern to develop; not with service continuity of a huge power block at stake. Because they couldn't leave performance to chance, they chose the O-B insulation shown here.

Ohio Brass

4545-H



Insulating Oil Crisis

(*Continued from page* 25)

on factory work with both circuit breaker and transformer bushings, and that the power-factor test tap arrangement speeds up and safeguards such practice. In discussion, the increasing range and value of radio noise tests on bushings was noted. If the level exceeds 500 microvolts, immediate removal from service was advised.

Testing Progress . . . F. W. Wakefield, American Steel & Wire Co, described a high resistance bridge method for locating cable faults in both factory and field testing. The unit is portable; it employs a vacuum tube voltmeter with sensitivity of 0.7 millivolts per millimeter of deflection and an input resistance of 10 megohms. A 1,000-cycle generator is used for signal tracing, and hearing aid batteries power the pickup for detecting the signal and judging its intensity. The application is designed as an improvement on the usual Murray loop test.

Television Used to Inspect River Bed at The Dalles

A closed-circuit television camera operating on a robot-controlled frame moving on the river bed has been used by Army Corps of Engineers to inspect the bottom of the Columbia River at the Dalles Dam project. Lt Col David S. Parker, acting Portland district engineer, reported the camera relays to a screen above water a picture from which the corps can observe the general relief of the river bed at the area of the closure dam.

Specifically, the corps can determine whether there is any gravel or rock deposit which would underlay the zone where engineers intend to place impervious material to close the river.

The corps believes it marks the first time a television circuit has been used for this purpose, although it has been used previously in underwater salvage.

The same camera, owned by Francis J. Maiken, Commercial Divers, Inc, Portland, was used in December at Grand Coulee Dam to examine erosion damage at the base of that structure's spillway. The frame used at The Dalles was developed jointly by the corps and Maiken and was operated from a drill barge.

Herbicides Discussed at Parley

Northeastern Weed Control Conference hears report on the effectiveness of various methods, preparations, and techniques

Herbicides and methods of application for brush control were discussed by representatives of manufacturers, educational institutions, and users at the Northeastern Weed Control Conference last month at New York City. Their reports included continued experience with established methods and several new techniques.

Effect of amino triazol on woody plants treated during the summer of '53 was reported by W. A. Meyers, American Chemical Paint Co. He said that 9 to 12 lb per 100 gal of water applied to run off on foliage and stems killed most white ash and black oak to the ground line after one year. With rates of 6 to 15 lb as a foliage spray no acorns developed on scrub oak, and stems of mockernut hickory remained green but without leaves.

Amino Triazol Controls Poison Ivy . . . Complete control of poison ivy resulted from 1 lb per acre in water, said Meyers. Sumac, red maple, blueberry, dogwood, and viburnum were affected at high rates, but most show signs of recovery.

A new electrical method of killing woody plants will soon be tried, related W. A. Niering, Connecticut College. Another experiment is the use of low shrubs in high density to keep trees out of a right of way.

Penn State Conducts Tests . . . Continuing tests on control techniques for a Pennsylvania power line right of way having an oak-hickory forest were reported on by W. C. Bramble, Pennsylvania State University. A total of five different treatments were applied —four during the early summer of '53 and one in the winter of '54. Most effective was a semi-basal summer spray consisting of 6 lb of 2,4D plus 2,4,5-T, half and half, combined with 10 gal of No. 2 fuel oil and 87 gal of water. Next in line was a general summer basal spray of 2,4D plus 2,4,5-T, half and half, at 12 lb concentration in No. 2 fuel oil to make up 100 gal.

A user of 2,4D plus 2,4,5-T in an oil-and-water carrier, Ralph Kauffman, Asplundh Tree Expert Co, cited the following as an effective procedure for brush control on rights of way:

After the brush is cut, the herbicide is applied as a summer basal. The following year the area is spotted with a summer basal. This gives initial control, and some maintenance is subsequently required. Kauffman said that summer basal is more effective than winter basal because leaves, etc, cover the base of the shrubs in the winter forcing the use of more chemical and time.

Another test at Pennsylvania State University indicates that with 2,4,5-T the most effective technique for killing bear oak is a dormant treatment by wetting the root collar. D. P. Worley said that a high volume with low concentration seems to be better than low volume with high concentration. But because of loss, concentrations up to 12 to 16 lb acid per 100 gal of water are necessary for certain kill. Effectiveness of spray applied near the base of the oak increases markedly to about 14 fl oz per plant.

W. C. Green, Connecticut State Highway Dept, pointed out that it uses 2,4,5-T as a basal spray for eradicating wood growth after the brush is cut. One reason for cutting first is to avoid brown outs which cause poor public relations. Foliage spraying is not permitted.

Soviet Power Output in '54 Reported to Be Up 11%

Russia claims it boosted power output to record peaks in 1954.

A report issued by the USSR Council of Ministers' Central Statistical Administration says that electric energy output last year was 11% higher than in 1953 and three times as high as in 1940. The Ministry of Electric Stations reportedly achieved 103% of its overall goals for the year.

Specific power output figures were not given for 1954. However, based on the claimed production of 133 billion kwhr in 1953, the 1954 output would be about 147.6 billion kwhr.

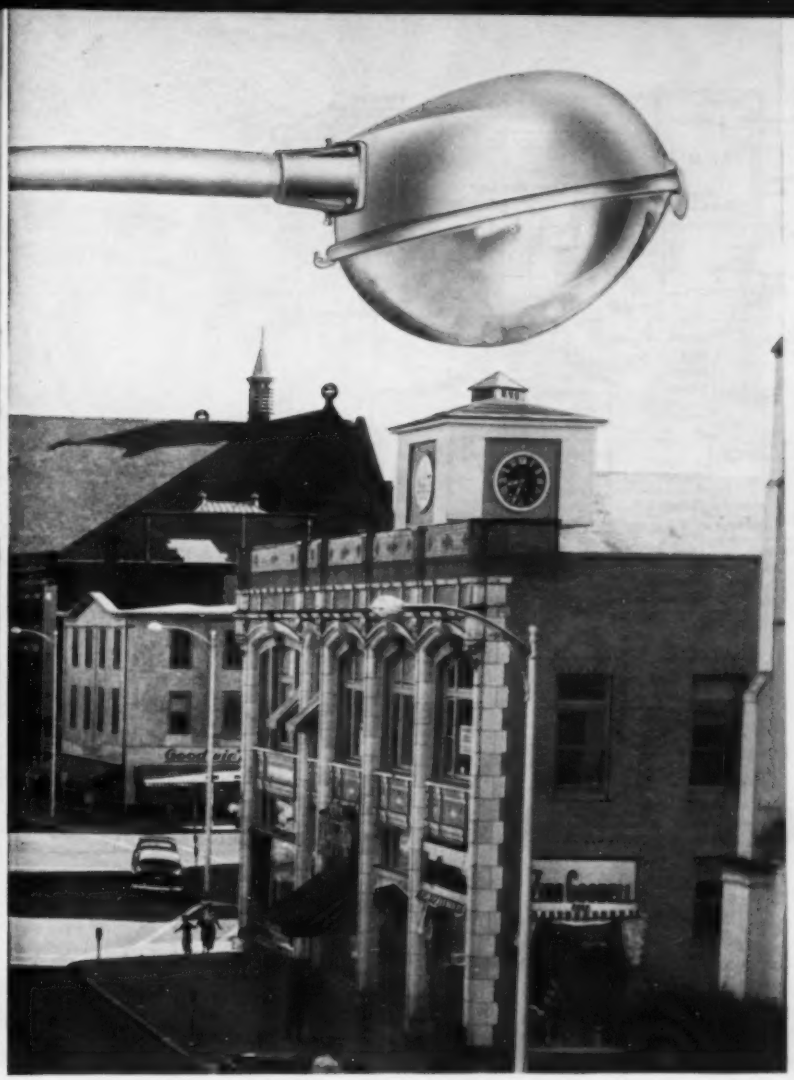
New G-E FORM 400 Luminaire Provides

New mercury street light is easier to service, and offers greater flexibility

The new General Electric Form 400 luminaire is an important advancement in mercury street lighting. Besides providing better over-all visibility through improved optical performance, the new Form 400 is unusually economical to install and maintain.

BETTER LIGHT CONTROL—The unique tilted optical system of the Form 400 puts more light on the street for a new high in utilization efficiency. It also lights the pavement more uniformly over its entire area. Glare is minimized through more effective shielding of the light source. No other mercury street light has ever achieved such superiority in all these factors of visibility.

EASIER SERVICING AND GREATER FLEXIBILITY make the new Form 400 exceptionally economical. The hinged glassware swings down to provide complete accessibility for relamping or cleaning. No tools are required to detach the glassware or reflector from the unit. Sepa-



Better Over-all Visibility

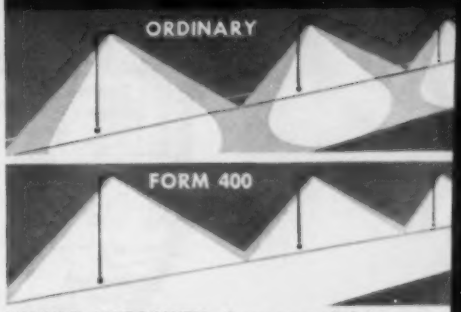
rate, snap-in reflectors provide a choice of either Type II or Type III distribution using the same glassware. Five different mercury lamps may be used, and you have a choice of either multiple sockets for conventional ballasted operation, or an entirely new series socket for Ballastless Mercury Systems.

MORE INFORMATION on this outstanding new development in mercury street lighting is available from your nearest G-E Apparatus Sales Office or Authorized Agent, or by sending in the coupon. Section 452-153, Outdoor Lighting Department, General Electric Company, West Lynn 3, Mass.

Progress Is Our Most Important Product

GENERAL ELECTRIC

BETTER LIGHT CONTROL



GREATER UNIFORMITY of pavement brightness and a new high in utilization efficiency are achieved by the new Form 400 luminaire.

NEW EASE OF SERVICE

HINGED GLASSWARE speeds up maintenance of the new Form 400. Both reflector and glassware can be detached without using tools.

GREATER FLEXIBILITY

FIVE DIFFERENT LAMPS, multiple or series sockets, and either Type II or Type III reflectors can be used in the new Form 400.

WRITE FOR FULL INFORMATION

Section A452-153, Outdoor Lighting Dept.
General Electric Co., West Lynn 3, Mass.

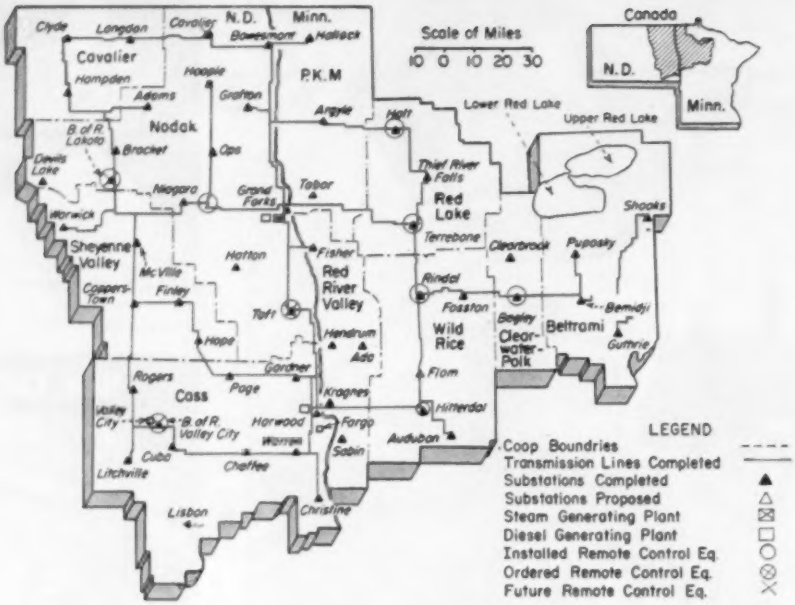
Please send me full information on the new Form 400 Mercury Luminaire

Name .....

Company .....

Street .....

City ..... **State** .....



Supervisory Control Over 14 Stations

MARVIN H. GEBHARDT, System Operations and Planning Engineer, Minnkota Power Cooperative, Inc, Grand Forks, N. D.

Minnkota Power Cooperative, Inc, today operates a 14-station supervisory control system to assure service continuity to its 40,000 rural customers for whom service interruption means loss of capital. The co-op has placed an order to expand this system to include two additional remote stations.

In the sections of northwestern Minnesota and northeastern North Dakota served by Minnkota's 1,200 miles of 69-kv transmission lines, farm load no longer consists of light bulbs. Brooders, furnaces, water heaters, pumps, grinders, and other equipment need better service continuity than can be afforded by manual operation of sectionalizing switches. Bad weather and, particularly, snow on the roads slowed up men trying to reach the switches.

Since the installation of motor operation of the sectionalizing switches and supervisory control through power-line carrier equipment, sectionalizing operations can be completed in minutes instead of hours. Switching and communication are push-button operations in the dispatcher's headquarters.

Loop Design . . . A power-line carrier system now transmits supervisory information to remote stations, some more than 100 miles from headquarters. Optimum reliability is obtained by arrangement of transmission lines in a series of loops, allowing any section of the line to be isolated easily. Power can then be fed up to both sides of the fault, thus reducing service interruption to a minimum.

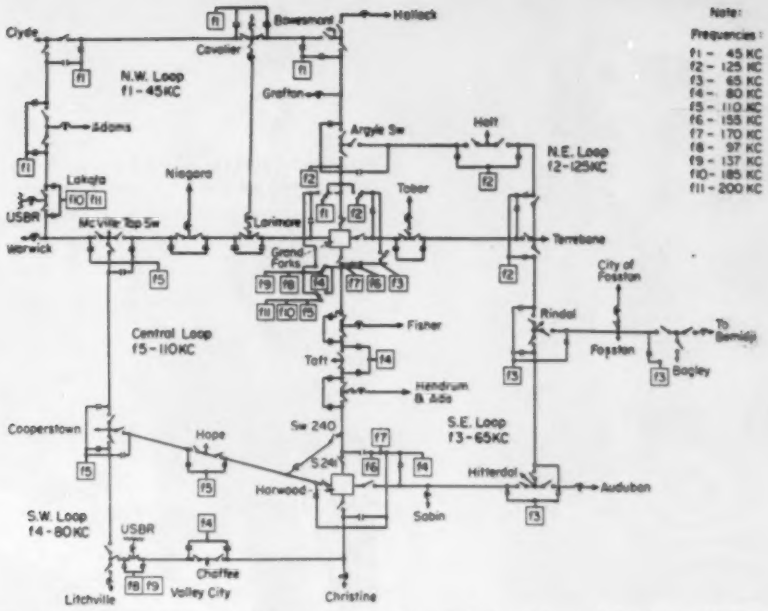
The five loops are shown at top right, together with the switches which can be operated by the new supervisory control equipment. For communication purposes each loop has a separate power-line carrier frequency, and each loop is isolated from the others.

Special line traps, with a maximum current rating of 60 amp, preclude carrier frequencies from stub lines, thus preventing the impedances of the stub lines from causing reflections on the main system.

The remote switching operation is controlled by the system load dispatcher at Grand Forks, N. D., headquarters. From there he operates the remote motor-operated switches and oil circuit breakers as required to sectionalize and isolate faulted line sections. The switches are of the air-break, non-load-break style, and most of those now in use are of the pole-mounted type.

A switching arrangement at Grand Forks allows the dispatcher to select the path over which the carrier signal will travel to reach both sides of a faulted section. When the fault is in the line of loop No. 1, for example, the carrier signal can be sent out over the line to the west or the line to the north.

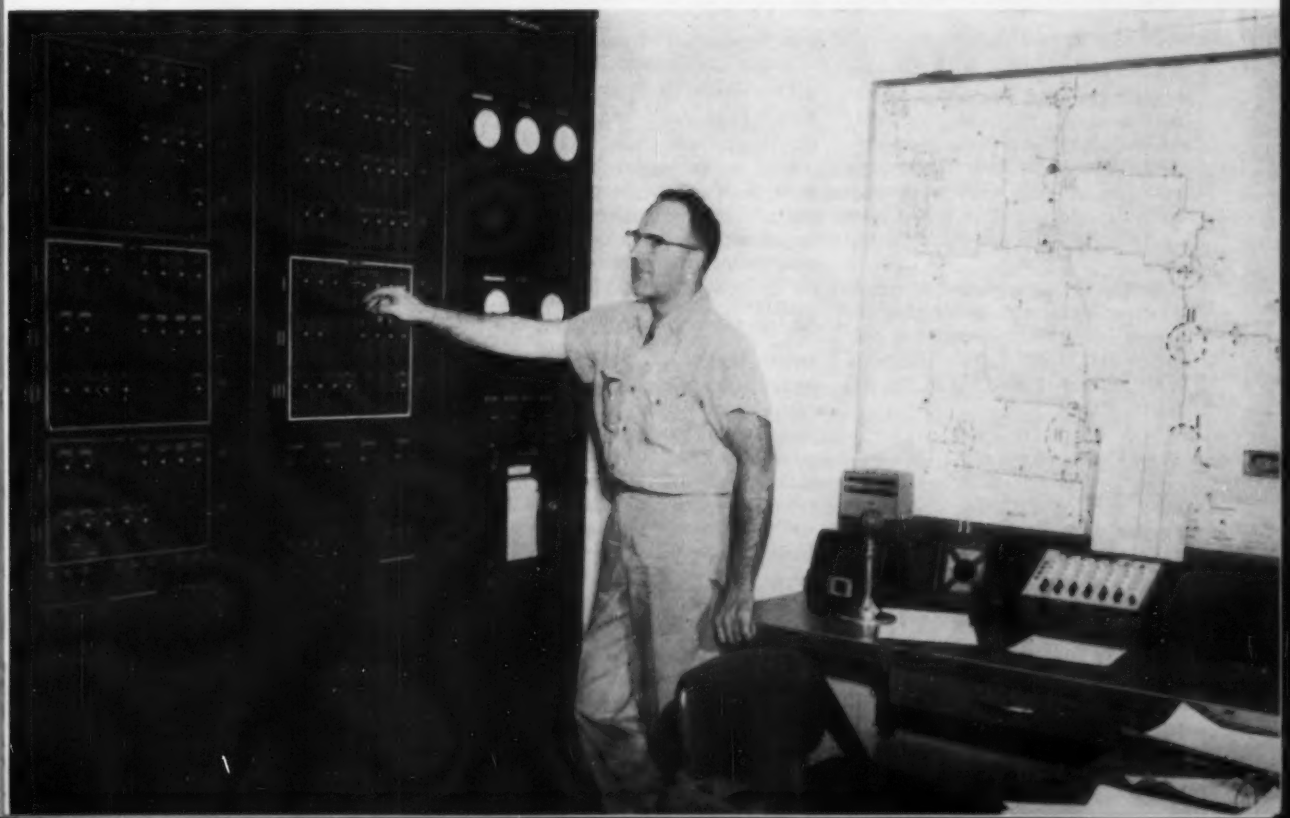
Headquarters . . . On the wall in front of the dispatcher is a large system map keyed into the supervisory control system by a station color coding and switch numbering scheme. This

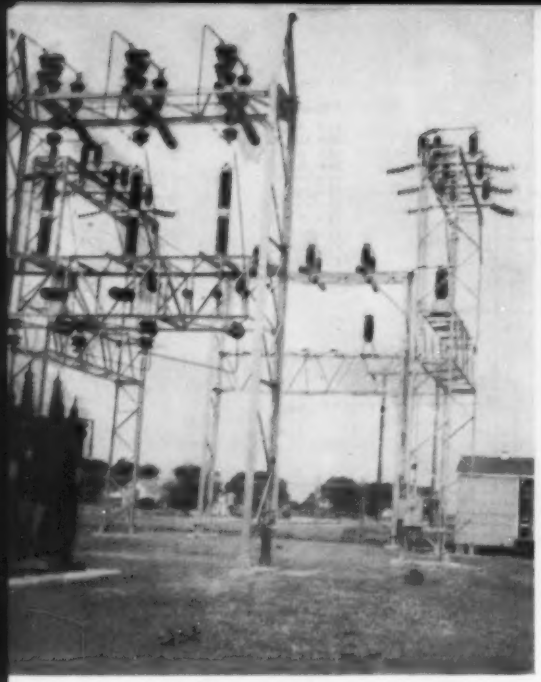


SWITCHING POINTS, 14 in all, on five 69-kv transmission loops are operated by supervisory control from Grand Forks dispatcher's office. Each loop (shown above) has a different carrier current frequency making communications on each independent of other loops

Backs Up Service on Rural System

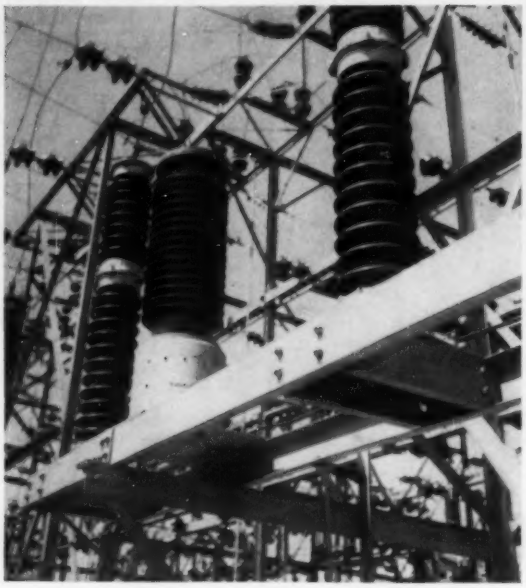
SUPERVISORY CONTROL permits operation of switches, often more than 100 miles away, by touching a button in the Grand Forks dispatcher's office. Map of transmission system on the wall at right is keyed into supervisory system by color code and switch numbering





MOST SWITCHES are of pole-top, air-break, non-load-break type and are motor operated

APERIODIC COUPLERS, installed at substations and switch points, are part of current carrier system



System Telemeters Voltage, Current Selectively

scheme has simplified the supervisory system operation so that it is not necessary to have a thoroughly trained dispatcher available around the clock. For 16 hr each day the dispatcher is off duty, while an operator from the adjoining steam power plant operates the supervisory control system.

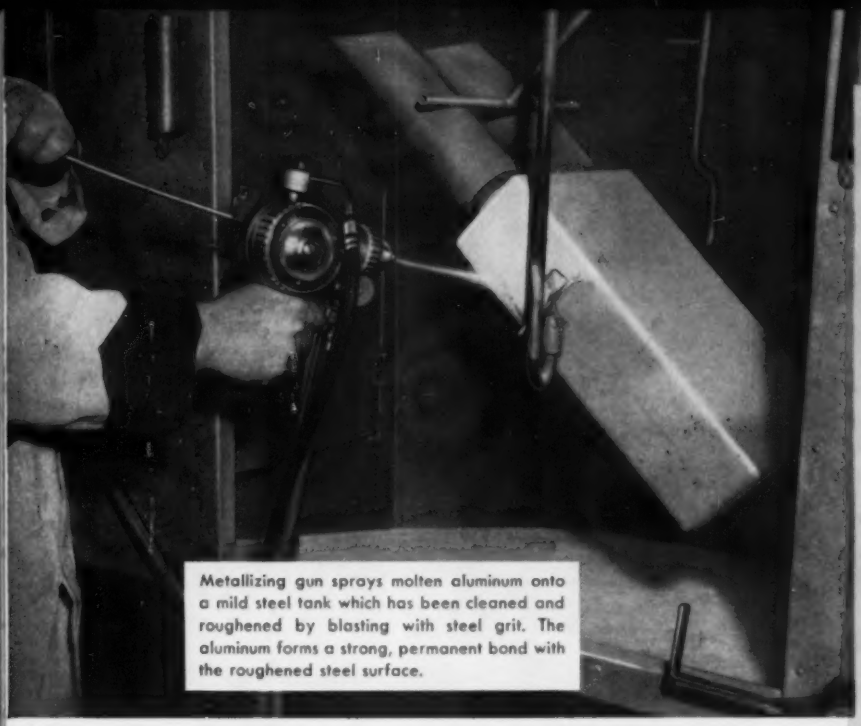
Besides controlling some 40 remote air-break switches and breakers, the supervisory control system can telemeter voltage and current selectively from the nine substations in the system.

Voice Communications . . . As supervisory control signals occupy only a small part of a carrier channel, a simplex voice frequency channel has been multiplexed above the supervisory control tone signals. This provision for point-to-point voice communications permits a rapid interchange of information between line crews at distant points in the system.

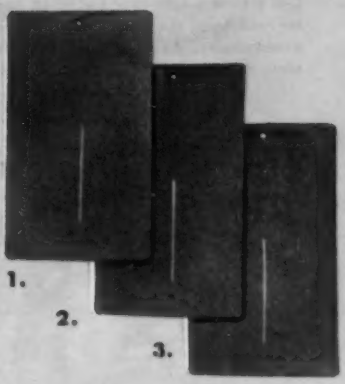
A cordless switchboard terminates the five carrier channels at the Grand Forks dispatcher's office. As each circuit operates on a different frequency, a switchboard patch arrangement is necessary to permit cross-conversation between remote stations on different carrier frequencies. The switchboard allows communications on either a private-line or party-line basis.

Standby Power . . . Standby power to operate the carrier and supervisory control equipment at remote sites is provided by a battery-operated motor-generator set. Heavy-duty nickel cadmium storage batteries give the most satisfactory operation in this part of the country. Compared with the ordinary type of storage battery, the capacity of the nickel cadmium battery remains essentially constant, regardless of extreme variations in temperature which characterize the region's year-round climate.

NICKEL-CADMIUM batteries operate a motor-generator set to furnish stand-by power



Metallizing gun sprays molten aluminum onto a mild steel tank which has been cleaned and roughened by blasting with steel grit. The aluminum forms a strong, permanent bond with the roughened steel surface.



1. Steel panel which has been aluminum-metallized, primed, and finish-coated. A deep gouge has been made down to the bare steel.

2. Identical panel, after 160 hours' exposure to standard ASTM salt spray test. Note there is no corrosion in the scratch.

3. A similar panel, after 1034 hours in the salt spray. No corrosion has occurred where the bare steel has been exposed, demonstrating aluminum's protective quality.

L-M Aluminum Metallizing Increases ELEMEX® Capacitor Tank Life

Capacitor tank corrosion now postponed indefinitely with aluminum metallic coating under the paint.

By **BLAINE SCHULTZ**
Section Engineer
Line Material Company

The tanks of Elemex capacitors have had excellent protection with the alkyd resin paints we have used. These paints have shown remarkable life under both laboratory tests and severe service conditions.

On a few occasions some corrosion has occurred, caused either by rough handling that damaged the paint finish, or by exceptionally corrosive atmospheres. Rather than provide special treatment for such situations, we are now applying a coating that will meet almost any demand that can be placed upon it.

This process consists of aluminum metallizing, followed by a chromate primer coat and a finish coat of alkyd resin paint. The finish coat is dark in color to expedite heat radiation and keep the capacitor packs at low operating temperatures.

Why Aluminum Is Preferred

A number of possible metal coatings were tested. Aluminum was selected because of a number of important advantages. One is that aluminum is a "sacrificial" metal. If, during handling, a capacitor tank should be scratched through the paint and the aluminum coating, down to the steel, the aluminum will prevent oxidation of the steel by "sacrificing" itself. This can be demonstrated on a scratched panel with the bare steel exposed. Even after lengthy exposure in a salt spray test, the steel stays clean and free from oxidation.

Aluminum is also harder than other non-ferrous metals and resists cuts and abrasions better. It is also compatible with prime and finish coats of paint which are applied over it. It will not form corrosion products which leach through or cause blistering of paint film.

For these reasons aluminum is greatly preferred over other non-ferrous metals and was selected for the protection of Elemex capacitor tanks. This process is now being applied to the mild steel tank of all outdoor Elemex capacitors.

Other Features of L-M's Elemex® Capacitors

Packs are assembled in air-conditioned rooms to assure uniformity.

Every pack is individually tested with over-voltage to detect any actual or potential defects.

Elemex capacitors are individually dried and completely impregnated under vacuum.

Exclusive "Paragroove" clamp-type terminal has low resistance, less heating; no parts to remove when connecting; rugged construction; simplifies wiring.

Strong solder-sealed bushings are one-piece wet-process porcelain, with two metallized bands over the glaze. It takes more than 3000 pounds to push an L-M bushing out of the cover.

Uniform terminal height above mounting flanges in any voltage class for convenient interchanging of capacitors.

Choice of standard or low temperature Elemex liquid dielectric.

Get Complete Information on Elemex Capacitors

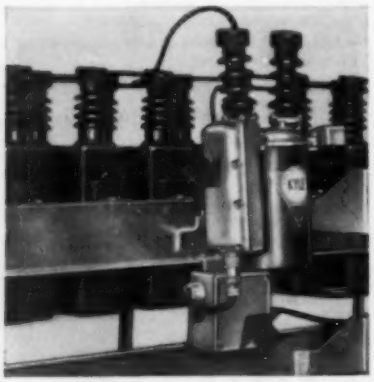
Elemex capacitors offer many desirable features. They are available in 15 and 25 kvar sizes, in ratings from 2400 to 13,800 volts. Ask the L-M Field Engineer for a copy of Bulletin PC1, or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

195

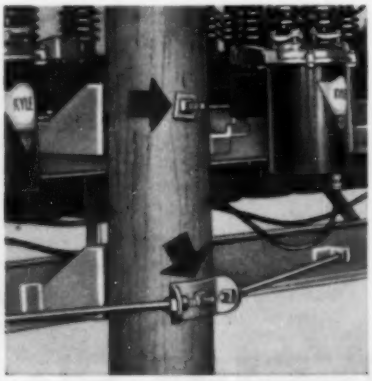
LINE MATERIAL *Elemex® Capacitors*

L-M's new single-row switched capacitor rack hugs the pole, provides greater accessibility. Assembly is easier to install, inspect, and maintain.

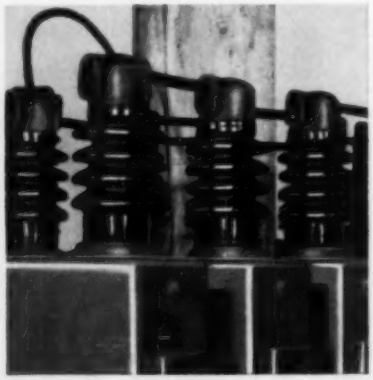
Junction Box: provides one connection point for control wiring; assures quick, easy installation and maintenance. Also note plug-in connection to switch control box.



Direct Pole Mounting: Only two bolts are required to mount L-M's single-row rack, greatly reducing installation time and pole space requirements.



Bird-Proof: an outstanding feature is the bird-proof construction. Neoprene rubber caps cover the terminals, and high-voltage connections are made with 5 kv insulated conductor.



Greater Accessibility, Less Bending Moment...

L-M's New Single-Row Capacitor Rack For Direct Pole Mounting

L-M's factory-assembled and wired, single-row capacitor racks are easier to install, inspect, and maintain. Center of gravity is close to pole, which reduces bending stress on pole.

By N. K. DELANEY
Manager of Capacitor Sales
Line Material Company

L-M's outstanding Elemex® capacitors are now available in single-row capacitor racks for direct pole mounting. The racks are factory-assembled and wired, shipped ready for installation on distribution systems rated 2400 to 13,800 volts. Bank sizes may be 225 or 300 kvar.

Single-Row Design

New single-row design provides greater accessibility; assures easier inspection and maintenance of the unit. In addition, L-M's new design brings the center of gravity closer to the pole, and thus reduces the bending stress on the pole.

Direct Pole Mounting

You can reduce installation time and pole space requirements with L-M's direct pole-mounting design. Direct pole mounting eliminates double hanger arm and kick arm. All you do is bolt to pole and connect.

Switched racks are provided with L-M's rugged, dependable, motor-operated "NR" switches. The switches are easily accessible for hook-stick operation. They are equipped with an exclusive plug-in connection for control wiring. This provides a quick, convenient means of disconnecting the switch for servicing.

Get Complete Information

Ask the L-M Field Engineer for complete information about L-M's new single-row capacitor rack and other capacitor equipments, also about L-M's Capacitor Bank Engineering Service. Or write Mr. Delaney, Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Co. Division).

Other Features Of L-M's Single-Row Capacitor Rack Assemblies

- The single-row capacitor rack assembly incorporates many desirable features, assuring greater accessibility, dependable service. These include:
- Only one connection point for control wiring.
- Disconnect plugs on switches; switches can be easily removed for maintenance.
- Interchangeable switch mounting positions to meet various primary circuit configurations.
- Complete bird-proof construction; neoprene rubber caps on terminals, plus 5 kv insulated conductor for high-voltage connections.
- Lifting yoke; makes pole top hoisting easy.

L-M Offers Complete Line of Capacitor Equipments

Factory-assembled single-row or standard three-row racks for pole-mounted banks. Sizes with 15 kv spacing up to 300 kvar switched and 375 kvar unswitched assemblies with 25 kvar units.

Factory-assembled blocks in complete range of NEMA-standard sizes and ratings. Blocks save time and money in assembling large banks.

Metal-enclosed capacitor equipments in all NEMA-standard distribution voltage sizes and ratings.

VDS Method factory-assembled block for large multi-step capacitor banks at transmission voltages, an L-M-exclusive method that reduces cost of switching equipment.

Dependable Kyle® Switch: racks are supplied with L-M Kyle Type NR Oil Switches, 200 ampere thermal rating and full 150 ampere nominal capacitive rating at 15 kv.

LINE MATERIAL

Elemex® Capacitors

Ready Promoted to VP

W. J. READY

W. J. Ready, controller for South Carolina Electric & Gas Co since 1943 and a member of the board of directors since 1952, has been named vice president of SCEGCo and South Carolina Natural Gas Co. He will retain his responsibilities as controller.

A certified public accountant, Ready joined a predecessor company of SCEGCo in 1925. He served in various accounting capacities and had risen to supervisor of accounting when he was named controller for the company.

He is a member and past president of South Carolina Association of Certified Public Accountants, a member of American Institute of Accountants, and has served as chairman of accounting section of the Southeastern Electric Exchange.

A. M. TULLO

VINCENT GERBEREUX

Worthington Makes New Appointments

Worthington Corp has announced these appointments: Aloysius M. Tullo was appointed general manager of a newly established division to be known as the Harrison Division and Vincent Gerbereux has been chosen as general manager of a new division to be known as the Standard Pumps Division.

Tullo will be responsible for all phases of Worthington's Harrison operations, including sales, engineering, and manufacturing. He came to Harrison in April of last year to succeed Elston J. Tribble as works manager when Tribble was promoted to assistant vice president-manufacturing. Previously Tullo had served as works manager of Worthington's works at Wellsville, N. Y., since 1951.

Gerbereux, who has been with Worthington since 1924, has been manager of the Centrifugal Pump Division of the General Sales Department since 1951.

Wright Assumes Additional Duties

R. E. WRIGHT

R. E. Wright has been named director of industrial and public relations of The Electric Storage Battery Co. In addition to the company's industrial relations, which he has directed since 1945, Wright now is responsible for all corporate public relations policies and programs, excepting stockholder relations.

He became assistant manager of industrial and public relations at United States Rubber Co's Detroit plant in 1926. He entered the U. S. Navy in 1941 and was labor relations officer of the Fifth Naval District throughout World War II.

Wright was employed by ESBCo as industrial relations director upon his release by the Navy. He has been active in two projects of the President of the United States—Committee for Employment of the Handicapped (1951) and Conference for Occupational Safety (1953).

POWERS *American*®

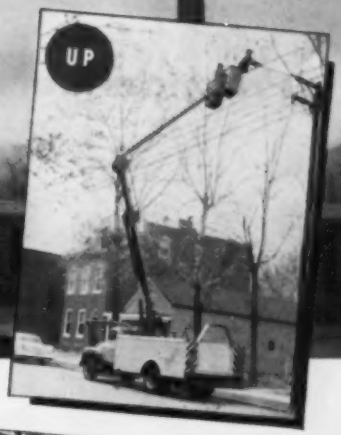
presents the

"Sky-Master"

HYDRAULIC AERIAL BEAM

THE ULTIMATE IN AERIAL EQUIPMENT

IN TWO SIZES... FOR ALL TYPES OF OVERHEAD WORK



SKY-MASTER carries two men . . . in reinforced plastic work baskets . . . to *any* point within its wide range of movement. The supporting mast, which rotates on roller bearings, can be revolved continuously . . . in either direction. The hydraulically-actuated inner beam can be moved to any point in an 85° arc, and the outer beam—actuated in combination with drive pulleys and ¼" wire rope—can be spotted in any position within a 265° arc. Movement of the beams and mast is controlled by three independent levers beside the work baskets. Hydraulic outriggers, on each side of the body, furnish absolute stability regardless of SKY-MASTER'S position. Insulation against 50,000 volts is provided by an abrasion-resistant covering on the outer beam.

Operating features and construction details are described in Powers-American Bulletin No. 410. A copy, with price information, will be sent on request.

SKY-MASTER can be installed on a Powers-American Body which fits individual work requirements. SERIES AB-37 has a ground-to-basket floor height of 37', SERIES AB-43 extends to 43', enabling two men to work 48' above ground.

POWERS-AMERICAN DIVISION

McCABE-POWERS AUTO BODY COMPANY

5900 NO. BROADWAY • ST. LOUIS 15, MO. — 625 CEDAR STREET • BERKELEY 10, CALIF.

Practical service training at Honeywell's school...

makes your instrument men more valuable

YOUR instrument maintenance men can get a real education in the most up-to-date methods for servicing instruments, at Honeywell's Training School. Any organization which uses Honeywell instruments can send maintenance personnel to this school. Tuition costs you nothing, for this school is maintained as a "plus-value" service to Honeywell customers.

Thousands of technicians have either started or augmented their instrument knowledge here. A variety of courses is available, to fit men for the particular kind of maintenance problems they may encounter in their specific jobs. The comprehensive course . . . one of the most complete and intensive offered anywhere . . . covers about thirteen weeks. Other courses cover five weeks and less, to offer condensed instruction of either a basic or "refresher" nature to men who can't be spared for extended periods.

There's nothing academic about this school. The emphasis is placed on practical knowledge. Theory through lectures and textbook study is liberally supplemented by laboratory sessions and actual bench work on all types of instruments and related equipment.

One caution: classes have to be limited to assure thorough attention to all students, so make reservations in advance. Your local Honeywell office will be glad to make arrangements. Call today . . . it's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*,
Wayne and Windrim Avenues, Philadelphia 44, Pa.

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS

H HONEYWELL

First in Controls

D. F. WINTER

Moloney Electric Appointments

Moloney Electric Co has announced these appointments for the newly created Engineering Research and Development Laboratory: David F. Winter to become director of research and William C. Reinhardt, laboratory supervisor.

Winter joined the company as a consultant in 1950 and in 1954 obtained a leave of absence from Washington University to continue the development of a Specialty Transformer Section of the company. Reinhardt joined the organization as an engineer in May, 1950.

W. C. REINHARDT

Chanon Appointed Marketing Manager

Henry J. Chanon, manager of original installation sales at General Electric Co's Lamp Division at Nela Park, has been appointed marketing manager of GE's outdoor lighting department.

Chanon began his career with GE as a part-time employee in 1927. Following a year at Case Institute of Technology, he entered Ohio State University where he received a BEE degree in 1931 and an ME degree in 1936.

During his association with the Lamp Division, Chanon served as laboratory technician, photometry expert in engineering, street and highway application engineer, theatre and stage lighting engineer, district engineer for the South Pacific sales district, fluorescent lamp marketing specialist, and manager of GE's Lighting Institute at Nela Park.

H. J. CHANON

PERSONALS

Richard C. Waldron, senior engineer, has been named manager of engineering of Okonite Co, Passaic, N. J., and will supervise the activities of the engineering department. **Edward E. McIlveen,** previously cable engineer, has been made assistant manager of engineering . . . **Frank Womer,** vice president of Pennsylvania Electric Co, who for the past three years has been in charge of the Northwestern Division with headquarters at Erie, has been placed in charge of division operations with headquarters at Johnstown. **Kenneth H. Ishler,** division operating superintendent, will succeed Womer.

Max I. Alimansky has been appointed general manager of General Electric Co's rectifier department, Lynn, Mass., Alimansky, who has been manager of engineering for GE's distribution transformer department, replaces **William J. Fleming,** who has been granted a leave of absence for health reasons . . . **Charles W. Nash** has been assigned to the newly created post of director of load development for British Columbia Power Commission. **Lawrence E. Wright** takes over Nash's former job as manager of the Nanaimo-Duncan and Lake Cowichan Power Districts on Vancouver Island.

Eldon E. Fox, formerly advertising manager for Minneapolis-Honeywell Regulator Co, has been promoted to the newly created position of director of advertising and sales promotion . . . **F. A. Benty,** vice president of engineering for Iowa Power & Light Co, has been granted a leave of absence for reasons of health. Upon his return he will assume new duties as assistant to the president. **J. F. McLaughlin,** vice president, has been named manager of the engineering department under Executive Vice Pres J. T. Schilling. Schilling will also supervise a new operations department to be headed by H. R. Pearson and sales department headed by J. A. Sayre, who will also be responsible for purchasing. Sayre will continue to supervise the utility's 12 districts.

John Weir's resignation as manager of the Public Utilities Board of Ketchikan, Alaska, becomes effective April 1 . . . **Edward J. Kelly** has joined Westinghouse Electric Corp as general manager of the Television-Radio Division. Kelly was formerly a vice president of Emerson Radio & Phonograph Corp . . . **Max E. Chandler** has been elected comptroller and treasurer of Beaver Pipe Tools, Inc, Warren, Ohio. He formerly was with Western Reserve Lumber Co.

William G. Imboden, sales specialist for General Electric Co's Lamp Division with headquarters at Nela Park, Cleveland, has retired after 35 years' service with GE . . . **B. J. Dorsey,** district manager for Virginia Electric & Power Co at Charlottesville, Va., has been transferred to Norfolk to become district manager of the electric department there. Dorsey fills the office vacated by the late Joel H. Berry (EW, Feb. 21 p 184). Norfolk Manager **George F. Duborg** will transfer to Charlottesville as Dorsey's successor . . . **Norman M. Sted,** manager of the Cleveland district sales organization of U. S. Steel Corp's American Steel & Wire Division, has been appointed assistant general manager of sales.

Helping the industry meet its growing loads

Men . . . not bricks and steel . . . make this laboratory great

Westinghouse has cut another ribbon! This time, we're opening the doors at the Steam Division's new development laboratory near Philadelphia. Millions of dollars have been invested so that advanced development can bring you even greater value for your turbine dollar.

But it takes more than bricks and steel to build a great laboratory. It takes capable men. While the physical facilities here are equal to any in the world, the scientists and engineers now at work hold the real promise of great things to come from this project.

On the laboratory staff are men who are real leaders in prime mover development. Among them are those who brought you such famous Westinghouse developments as solid-forged rotors, stainless steel blading and the widely acclaimed Westinghouse governing system.

You will benefit from the laboratory through Westinghouse contributions to such organizations as AIEE, ASME and EEI. The laboratory will also bring you direct benefits—new and more advanced Westinghouse power plant equipment supplying more power at less cost and with greater dependability. J-97186

YOU CAN BE **SURE**...IF IT'S
Westinghouse

The new laboratory

Advanced development on turbine and heat transfer equipment will be conducted at the $6,000,000 Westinghouse engineering development laboratory in Philadelphia. This modern 4-story structure contains 40,000 square feet of laboratory space and is staffed by over 100 engineers and technicians. Facilities are the most modern that could be provided and include scientific apparatus from electronic computers to devices for handling radioactive isotopes.

Super-critical pressure

As the result of development work by the men who are staffing the new laboratory, the world's most efficient turbine with its surface condenser and feedwater heaters is now on order for Philadelphia Electric Company. The turbine is a 275,000-kw, super-critical pressure unit designed for 5000 psi, 1200°F—highest pressure and temperature ever projected.

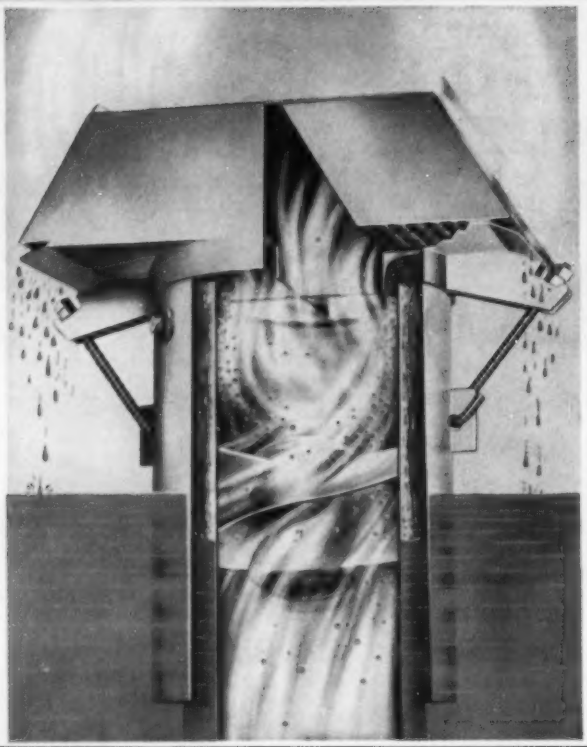
Gas turbines

Relative newcomers in the prime mover field, gas turbines show promise of becoming one of the industry's important future sources of power. New applications and improved efficiencies are some of the many development projects being advanced by the engineers at this new Westinghouse facility.

Westinghouse Research Center—

providing the wealth of fundamental knowledge that is carefully directed into industry advancements by the many Westinghouse development laboratories. Vital to Westinghouse emphasis on industry progress, this new Research Center will be the finest facility of its kind.

THE C-E TURBO-SEPARATOR . . .



another reason for the high availability of turbines served by C-E Boilers

Steam purity is a most important factor affecting the performance of present-day turbine generators. And the effectiveness of drum internals is the key to clean steam.

The true test of any system of drum internals lies in what it can do with the combination of water, steam and solids it must handle — not alone under steady base load conditions — but under all operating conditions.

Whether the concentration of solids in boiler water averages less than 100 ppm or even more than 1000 ppm — or whether it fluctuates anywhere between — the C-E Turbo-Separator maintains steam purity and quality well within satisfactory limits.

To be more specific — test results in a number of cases have shown less than .5 ppm and in some instances as low as .1 ppm. These results are supported by the fact that in no plant where Turbo-Separators are installed has there been any measurable loss of turbine capacity due to deposits on turbine blades.

When you add the proven advantages of C-E Turbo-Separators to the operating characteristics of modern designs of C-E Utility Boilers, you have the right combination for top year-around plant performance on all counts — efficiency, capacity and continuity of service.

B-815

HOW IT WORKS Steam-water mixture enters the top of the boiler drum through nozzles discharging into an annular space formed by internal baffles. Flow of the mixture is directed downward behind symmetrical baffles around the entire drum surface, maintaining a uniform drum-wall temperature, and then into the Turbo-Separators which are arranged in parallel rows throughout the length of the drum. They contain a center core and vanes which give the mixture a spinning or centrifugal motion, thereby throwing the water to the outer edges of the inner tube. Directly above the directional vanes and cores there is a skim-off lip which directs the water over the top of the inner tube and thence through the annular space to the drum. This is the primary separation stage. The relatively dry steam then passes through two opposed banks of closely spaced corrugated plates, which change the direction of the steam many times and throw out much of the remaining water. This is the secondary separation stage. The third and final stage of purification is accomplished in the screen dryer.

C-E

COMBUSTION ENGINEERING

Combustion Engineering Building
200 Madison Avenue, New York 16, N. Y.

BOILERS, FUEL BURNING & RELATED EQUIPMENT; PULVERIZERS, AIR SEPARATORS & FLASH DRYING SYSTEMS; PRESSURE VESSELS; AUTOMATIC WATER HEATERS; SOIL PIPE

MEETINGS CALENDAR

An extended list of coming meetings appears in the last issue of each month.

MARCH

AMERICAN SOCIETY OF MECHANICAL ENGINEERS—1st International Congress on Air Pollution, Hotel Statler, New York, March 1-2; Management Conference, Hotel Statler, Cleveland, Ohio, March 23-24.

EDISON ELECTRIC INSTITUTE—1st Street Tree and Utility Conference, co-sponsored with EEI Transmission and Distribution Committee, Street Lighting Committee of Illuminating Engineering Society and National Shade Tree Conference, Wade Park Manor, Cleveland, March 3-4; Industrial Relations Committee, EEI Headquarters, New York, March 17; 21st Annual Sales Conference, Edgewater Beach Hotel, Chicago, March 28-31.

NORTH CENTRAL ELECTRICAL LEAGUE—18th Annual Upper Midwest Electrical Industry Convention, Radisson Hotel, Minneapolis, Minn., March 6-9.

PACIFIC COAST ELECTRICAL ASSOCIATION—Engineering and Operating Section Conference, Hotel Huntington, Pasasdena, Calif., March 7-8.

CANADIAN ELECTRICAL ASSOCIATION—Western Zone, All Divisions, Bessborough Hotel, Saskatoon, Sask., March 7-9.

NATIONAL ASSOCIATION OF CORROSION ENGINEERS—Annual Convention, Palmer House, Chicago, March 7-11.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—Farm Electrification Conference, Morrison Hotel, Chicago, March 8-10; Utilization of Aluminum Conference, William Penn Hotel, Pittsburgh, March 15-17.

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION—Edgewater Beach Hotel, Chicago, March 13-18.

***PUBLIC INFORMATION PROGRAM**—Mid-Atlantic Region, Jefferson Hotel, Richmond, Va., March 21.

SOUTHEASTERN ELECTRIC EXCHANGE—Annual Meeting, Boca Raton Hotel and Club, Boca Raton, Fla., March 21-23.

***INSTITUTE OF RADIO ENGINEERS**—National Convention, Waldorf-Astoria Hotel and Kingsbridge Armory, March 21-24, New York.

ROCKY MOUNTAIN ELECTRICAL LEAGUE—Electric Meter Institute, University of Denver, Denver, Colo., March 21-25.

MISSOURI VALLEY ELECTRIC ASSOCIATION—Engineering Conference, President Hotel, Kansas City, Mo., March 23-25.

OKLAHOMA UTILITIES ASSOCIATION—Annual Convention, Mayo Hotel, Tulsa, Okla., March 24-25.

CONTROLLERS INSTITUTE OF AMERICA—Southern Conference, Mayo Hotel, Tulsa, Okla., March 25-26.

AMERICAN POWER CONFERENCE—17th Annual Meeting, Sherman Hotel, Chicago, March 30-31, April 1.

ILLUMINATING ENGINEERING SOCIETY—Southwestern Regional ference, Ft. Harrison Hotel, Clearwater, Fla., March 31-April 1.

APRIL

ILLUMINATING ENGINEERING SOCIETY—Southwestern Regional Conference, Gunter Hotel, San Antonio, Tex., April 3-5; South Pacific Coast Regional Conference, Statler Hotel, Los Angeles, April 14-15; Pacific Northwest Regional Conference, Harrison Hot Springs Hotel, Harrison Lake, B. C., April 25-26.

***ATOMIC INDUSTRIAL FORUM, INC.**—Meeting on "Atomic Energy—The New Industrial Frontier," jointly sponsored by Stanford Research Institute, Mark Hopkins Hotel, San Francisco, April 4-5.

***15TH ANNUAL YOUNG MEN'S UTILITY CONFERENCE**—Ipalco Hall, Indianapolis Power & Light Co., Indianapolis, Ind., April 6-7.

PACIFIC COAST ELECTRICAL ASSOCIATION—Joint Conference with Pacific Coast Gas Association, Administrative Services and Accounting Section, Jokane Inn, Phoenix, Ariz., April 7-8.

SOUTHEASTERN ELECTRIC EXCHANGE—Engineering and Operating Section, Roosevelt Hotel, New Orleans, La., April 7-8.

AMERICAN INSTITUTE OF ELECTRIC ENGINEERS—Southern District Meeting, St. Petersburg, Fla., April 13-15.

NORTHWEST ELECTRIC LIGHT & POWER ASSOCIATION—Engineering and Operation Section with Personnel and Safety Section, Davenport Hotel, Spokane, Wash., April 13-15.

***ROCKY MOUNTAIN ELECTRICAL LEAGUE**—Annual Spring Conference, Shirley-Savoy Hotel, Denver, Colo., April 17-19.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS—Spring Meeting, Lord Baltimore and Southern Hotels, Baltimore, Md., April 18-21.

NORTHWEST PUBLIC POWER ASSOCIATION—Annual Meeting, Eugene Hotel, Eugene, Ore., April 20-22.

AGRICULTURAL AND MECHANICAL COLLEGE OF TEXAS—8th Annual Conference for Protective Relay Engineers, Sponsored by Department of Electrical Engineering, College Station, Tex., April 25-27.

***EDISON ELECTRIC INSTITUTE**—Industrial Relations Committee, EEI Headquarters, New York, April 21; Meter and Service Committee, Washington-Duke Hotel, Durham, N. C., April 25-27.

CONTROLLERS INSTITUTE OF AMERICA—Eastern Conference, Royal York Hotel, Toronto, Ont., April 28-30.

*MAY

ILLUMINATING ENGINEERING SOCIETY—Midwestern Regional Conference, Edgewater Beach Hotel, Chicago, May 2-3.

EDISON ELECTRIC INSTITUTE—Transmission and Distribution Committee, Statler Hotel, Detroit, May 3-4; Purchasing and Stores Annual Spring Meeting, Dinkler Tutwiler Hotel, Birmingham, Ala., May 8-11; Prime Movers Committee, Biltmore Hotel, Los Angeles, May 9-10; Accident Prevention Committee, Pfister Hotel, Milwaukee, Wis., May 9-10; Industrial Relations Committee jointly with Personnel Administrative Section; Southeastern Electric Exchange, Netherlands Plaza, Cincinnati, Ohio,

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—Middle Eastern District No. 2, Columbus, Ohio, May 4-6; Electric Heating Conference, La Salle Hotel, Chicago, May 10-11.

NORTHWEST ELECTRIC LIGHT & POWER ASSOCIATION—Business Development Section, Hotel Utah, Salt Lake City, May 9-11.

PACIFIC COAST ELECTRICAL ASSOCIATION—Annual convention, Palace Hotel, San Francisco, May 11-13.

NATIONAL TELEMETERING CONFERENCE-EXHIBIT—Sponsored by Institute of Radio Engineers, American Institute of Electrical Engineers, Institute of Aeronautical Sciences, Instrument Society of America, Morrison Hotel, Chicago, May 18-20.

HURRICANE VETERANS compare experiences and recommend improved methods for restoring distribution systems following storms.

Hurricanes Show Need for National Mutual Aid Pool

Panel of utility engineers finds present regional plans for cooperation in emergencies inadequate to cope with restoration problems posed by widespread storms

A nation-wide mutual assistance pact of utility distribution crews and equipment should replace existing regional pools which proved inadequate to handle restoration operations during hurricane Edna, Carol, and Hazel.

This was the prime recommendation of a panel of 11 utility engineers who took the distribution systems of the Northeast through last fall's epidemic of hurricanes.

Other recommendations of the panel which was convened during the Transmission and Distribution Committee meeting of the Edison Electric Institute in Washington, D. C., Feb. 11-12 grew out of lessons learned during restoration. They were these:

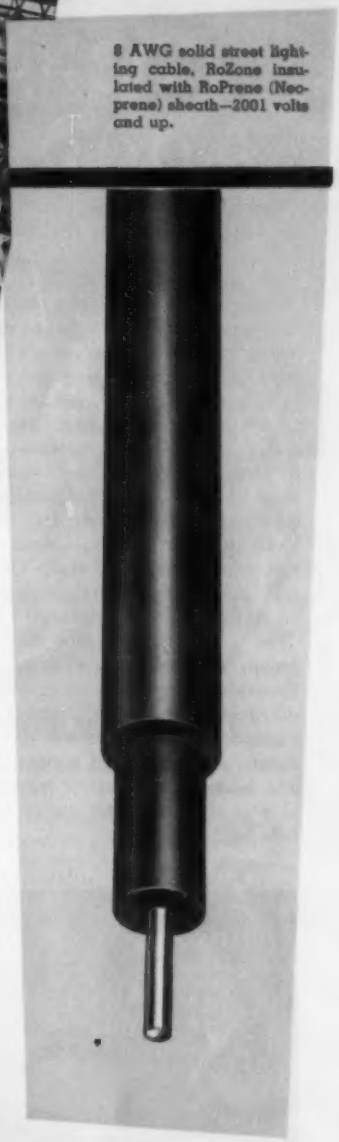
- Patrol early. Report damage in simple units, by type. Route reports to damage control headquarters, fast. Patrol crews need walkie talkies.
- Split working forces into smallest practical groups. Use meter readers, inspectors, and the like to guide foreign crews.
- Provide ample supervisors who can be first line of restoration, make decisions, bring in progress reports.
- Concentrate on getting right men to right place at right time. Plan procedures carefully. In end it takes men who can climb to restore service.
- Use trained tree crews. One is worth three line crews in restoration.
- Train non-operating personnel in advance to act as damage estimators.
- Use trouble trucks and pick-ups to "caddy" for construction crews.
- Design lines with heavier conductors (than No. 6) on 29-in. spacing (instead of 14½ in. flat.) This may minimize damage.
- String aerial cable to minimize tree damage. Few utilities have enough.
- Work crews on 12-hr shifts; 16-hr shifts do not provide enough rest.
- Establish emergency store rooms. Increase emergency stocks on hand.
- Transport crews by air to save time although this is objectionable to some linemen.
- Transport men in comfort so they arrive at destination rested and ready to work.
- Send trucks over the road with non-working drivers. Send drivers with crew so they will be fresh.
- Follow truck convoys with mechanics equipped with spare parts like tires, fan belts, distributor parts, etc, to fix lame ducks.
- Quarter foreign line crews on a high level. Treat them as guests. Give them better quarters than local crews.
- Consider renting railroad Pullman and dining cars for crew quarters.
- Motels make good housing. They can be "bought out." Front and back yard space makes good storage depots.
- Be frank with the public. Give no general answers. If you don't know, say so. Follow-up calls after restoration are appreciated.
- When storms threaten: Notify emergency personnel. Advise engineers and operators to take emergency measures. Print extra feeder maps for crew use. Get crews ready and dispersed to emergency locations. Put substation controls on "non-automatic" to cut live-wire hazards. Alert available tree contractor crews. Discontinue street light crew activity. Alert public relations personnel.

Room Air Conditioner Problems . . . The distribution engineers' problems with room air conditioners have no practical piecemeal solution. What steps are taken must effectively provide for the saturation which can be anticipated in the years ahead, W. M. Penny and V. J. Farmer, Union Electric Co of Missouri, told the T&D group.

With 60,000 room units on the St. Louis system rated 47,000 hp, Penny said, the best solution is to provide enough capacity in the average transformer to last five years. During that time normal load growth, plus air conditioning, is expected to average 1 kva per customer, in blighted areas 0.4 kva per customer. Transformer reinforcements engineered on this basis will put 7,000 more transformers and 2,650 larger transformers totaling

COMPARING NOTES following talks to T&D group are: George Whitwell, Philadelphia Electric Co, and George Jones, Air Conditioning and Refrigeration Institute

One phase of final inspection is the electrical testing, under water, of every foot of Rome RoZone. When the safety gate is lowered, high voltage current is applied to each reel of cable.



8 AWG solid street lighting cable, RoZone insulated with RoPrene (Neoprene) sheath—2001 volts and up.

Rome RoZone®

Superior Ozone-Resistant Insulation Deserves Your CONFIDENCE

What Its Uniformity Means to You...

Q: What is meant by uniformity?

A: Uniformity in service performance . . . foreknowledge of dependability, carrying with it the assurance that every length of RoZone insulated cable measures up to the same high standard of quality.

Q: Of what advantage is such uniformity?

A: Every time you install RoZone, you can be sure of identical performance under comparable service requirements.

Q: How does Rome Cable control uniformity?

A: By carefully supervised workmanship, backed by rigid manufacturing specifications and long experience in the exact compounding of quality insulation.

Q: How do we measure uniformity?

A: Through long-time laboratory and service tests, as well as a specially developed ionization level test which actually predetermines the insulation's behavior in service. Further, sampling tests for ozone resistance, electrical stability in water and aging properties are standard procedures.

In short, RoZone is a premium insulation, precisely compounded, manufactured on modern equipment, time-proven in service and step-by-step tested for high *uniformity of quality. It deserves your fullest confidence.*

It Costs Less to Buy the Best

RoZone is approved and accepted by leading utilities, industrials and consulting engineers

ROME CABLE
Corporation
ROME • NEW YORK
and
TORRANCE • CALIFORNIA

ROME CABLE ROME, N.Y.

330,000 kva on the system by Sept. 1, 1956.

Room air conditioners of the 1956 model will be the first to reflect the improved power factor characteristics agreed upon by the EEI-ARI committee, George S. Jones, managing director, Air Conditioning & Refrigeration Institute, reported. Beginning in 1946, ¾-hp units will have not less than 85% pf at full load, ½-hp units not less than 80% pf, and 1/3-hp not less than 75% pf.

Jones disclosed that the National Electric Code requirement which limits full load running current of room coolers to 80% of the rated capacity of single outlet circuits and 50% of multiple outlet circuits is effectively barring ¾-hp units from 115-v multiple outlet circuits.

George Whitwell, vice-president, Philadelphia Electric Co, urged distribution engineers to put today's problems with air conditioning and house heating in their proper perspective, not to sell load growth short. He presented a composite of six long range forecasts by industry authorities to show that by 1970 residential and rural sales would reach 450 billion kwhr. By the same year commercial and industrial sales will reach 750 billion and total sales by utilities will be well over a trillion kwhr.

At a joint session with the T&D group, members of EEI's Accident Prevention Committee asked help of distribution engineers in eliminating causes of fatalities and lost time accidents due to exposed ground, falls, and inadequate protective equipment as well as to improper use of motor vehicles.

Utilities Must Mass Distribute

. . . to keep in step with mass production, W. V. O'Brien, GE, tells MVEA's Industrial and Commercial Sales Conference

Utility companies must step up mass distribution to bring it in pace with mass production, W. V. O'Brien, vice president of General Electric Co told the Missouri Valley Electric Association, Feb. 3, at Kansas City. Addressing the association's Industrial and Commercial Sales Conference, O'Brien urged the industry to build up a favorable sales climate in which sufficient, trained sales personnel can perform in accordance with long-range selling plans.

Utilities today face the alternatives of raising rates or promoting services and appliances that complement each other for the building of a better load factor, J. E. Elliott, Southwestern Gas & Electric Co, declared. He urged the establishment of effective sales departments as the way to accomplish the latter. W. Dean Barnhizer, Iowa Electric Light & Power Co, urged the enlistment of trained sales personnel with engineering and architectural backgrounds.

Salesmen Will Come From Colleges . . . Citing the industry's role as a bulwark against encroaching socialism, Leslie G. Hawkins, association president, proposed repricing of the industry's services in line with the present purchasing power of the dollar. Recruitment of future salesmen, according to E. W. Gray, Oklahoma Gas & Electric Co, will be from other company departments and from the colleges, the aim being to obtain salesmen with a variety of talents for the different sales jobs.

Reporting experience with two residential heat pump installations equipped with supplementary resistance heating, H. M. Henry, Kansas City Power & Light Co, noted that load factors were in the order of 15% and that customers expressed enthusiasm for such installations. Demonstrations with portable equipment, he added, proved effective in selling them.

One Installation Promotes Another . . . S. S. Sansbury, Union Electric Co of Missouri, cited his company's experience with commercial and industrial electric heating, including heat pump and resistance heating jobs. Such installations, he said, had promoted extended use at the original locations and new installations at other locations of the same firm.

Exterior Lighting Balances Day Peaks . . . F. P. O'Connor, lighting specialist, St. Joseph Light & Power Co, said that this company offers a flat rate for exterior lighting loads of commercial establishments. Such lighting at motels, shops, car lots, undertaking establishments, and churches, he pointed out, has produced attractive revenues and has served to balance the trend toward summer daytime peaks.

Dual Fuses Mean Less Servicing . . . The conference heard C. G. Roush, Westinghouse Electric Corp, declare that atomic energy will be more important as a source of new fuel than as a source of cheaper electric power. With reference to the single-phasing of motors, T. C. Wier, Bussman Mfg Co, urged the use of dual-element fuses to reduce service calls.

Higher-voltage distribution, along with better use of materials, will reduce wiring costs and afford customers the maximum for their money, believes Marshall Havenhill, Kansas City P&L. Such factors, he said, will enable utilities to sell more power at the same cost to the customer and at greater profits to both customer and power company.

JOINT SESSION of T&D and Accident Prevention Committees of Edison Electric Institute bring together W. M. Penny, Union Electric Co of Missouri, left, R. P. Douglas, Detroit Edison, chairman of Accident Prevention group and R. W. White, safety engineer of the Pacific Gas and Electric Co for a brief exchange of views at Washington meeting

the J2 Meter is the SLOW SPEED METER

it's as simple as – 694,450 / 416,666

the J2 makes fewer revolutions *and fewer revolutions mean less wear . . . longer service life!*

The J2 Watthour Meter is the *slow speed meter*. It makes fewer revolutions than other meters—including the J2's predecessor, the Sangamo Type J—to measure the same load.

Fewer revolutions mean less wear on all moving parts . . . and *less wear means longer service life.*

Here's what this means in terms of only one year's time. The J2 has a 6.0 constant. It makes 166⅔ revolutions to measure one kilowatthour. The J Meter had a 3.6 constant. It made 277.7 revolutions to measure one kilowatthour.

Today's average residential load is 2500 kilowatthours. If you multiply this figure by 277.7, you get 694,450—the number of revolutions a 3.6 constant meter must make in order to measure 2500 kilowatthours.

Let's multiply 2500 kilowatthours by 166⅔, the speed of the J2 Meter. Here we get 416,666 revolutions per average load per year. And the difference between 694,450 and 416,666 is 277,784. In other words, the J2 makes 277,784 *fewer* revolutions in a year to measure the *same* load.

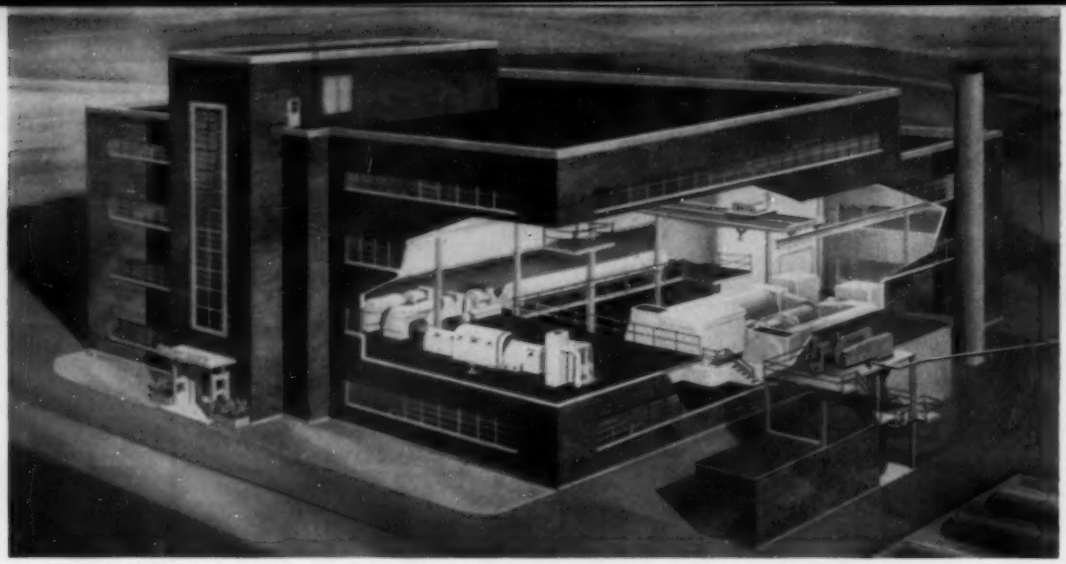
While the total fewer revolutions the J2 makes in only a year's time is impressive, think what it would add up to by 1985! Doesn't it stand to reason that there will be less wear on the moving parts of the J2? And with less wear on moving parts, it just naturally follows that the J2 will give many more years of trouble-free service.

the FIRST watthour meter with straight line accuracy up to 100 amperes!

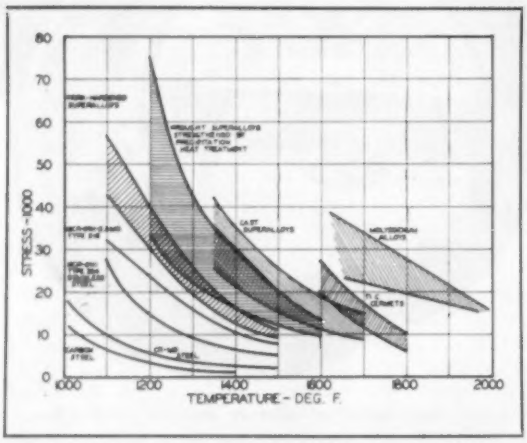
SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

JM33-2



NEW DEVELOPMENT LABORATORY is a 4-story, 100x150-ft structure with first-floor facilities for turbine and compressor testing



STRESS DATA to produce rupture in 1,000 hr are a developmental criterion for comparing materials and exploring alloy systems

Westinghouse Has

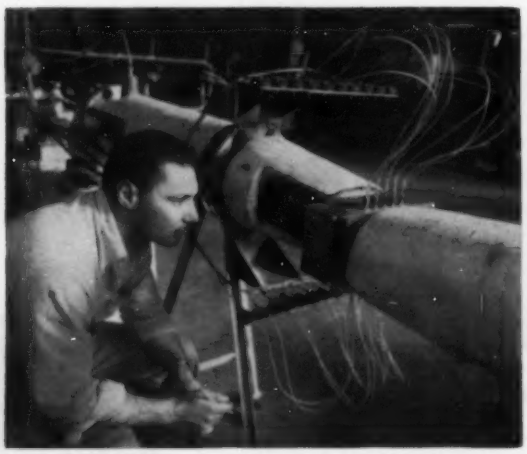
$6-Million facilities to investigate combustion,

Promise of significant future contributions to power production is seen in the new research and development laboratory opened recently by the Steam Division of Westinghouse Electric Corp at its South Philadelphia, Pa., plant.

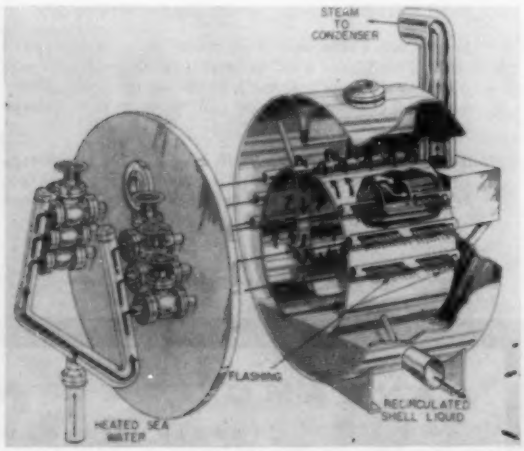
This $6-million laboratory has separate facilities for investigation of combustion, heat exchange, mechanical, aerodynamic, and hydraulic problems. Its eight principal components are:

1. Machinery hall for testing steam and gas turbine plants and components.

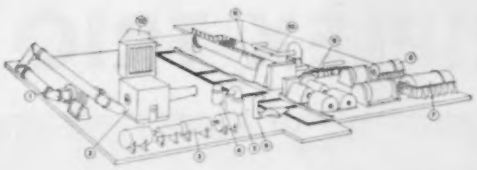
2. A closed-circuit wind tunnel powered by a 9,000-hp steam turbine for axial-flow compressor development.



BLADE CORROSION is measured by weight loss after exhaust gases pass specimens at velocity about that entering turbine nozzles

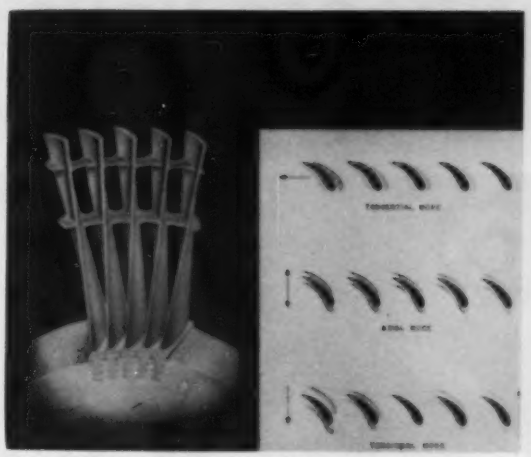


FLASH EVAPORATOR now under test uses low temperature waste heat sources for converting sea water to commercially pure water



1. Variable Density Compressor and Turbine Wind Tunnel
2. Blower Box
3. Transonic Leg of AEDC Wind Tunnel
4. Probe Calibration Rig
5. Exhaust Hood Tester
6. Diffuser Test
7. LP Turbine Tester
8. Multistage Tester
9. Turbine Blade Tester
10. Supersonic Leg of AEDC Wind Tunnel
11. Compressor Wind Tunnel
12. Large Cascade

AERODYNAMIC RESEARCH FACILITIES on second floor provide for air flow developments and exploring of blade characteristics



LOW-PRESSURE BLADES group-lashed can vibrate—tangential motion of tips, nearly axial motion of tips, torsional motion of blade group

New Steam Lab

heat exchange, all boiler, turbine problems

3. Aerodynamics laboratory for investigating turbine and compressor blading and other problems.

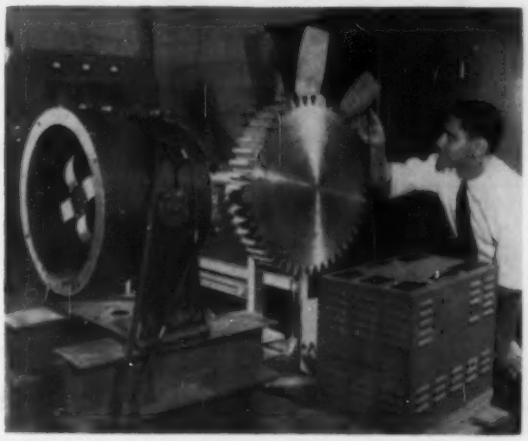
4. Combustion laboratory for gas turbine combustion and corrosion study.

5. Heat exchanger and hydraulics laboratory.

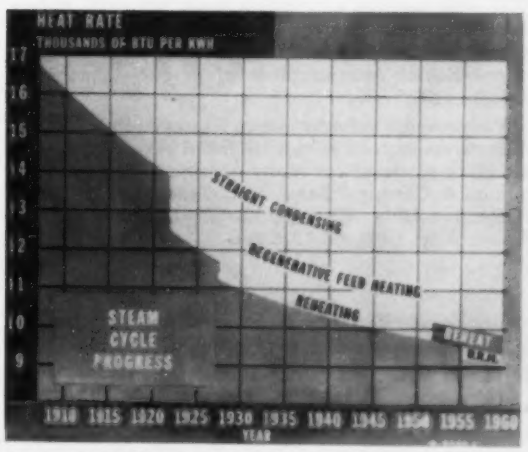
6. Mechanical laboratory for vibration, control, mechanical and lubrication studies.

7. Machine, woodworking, fabricating and model shop.

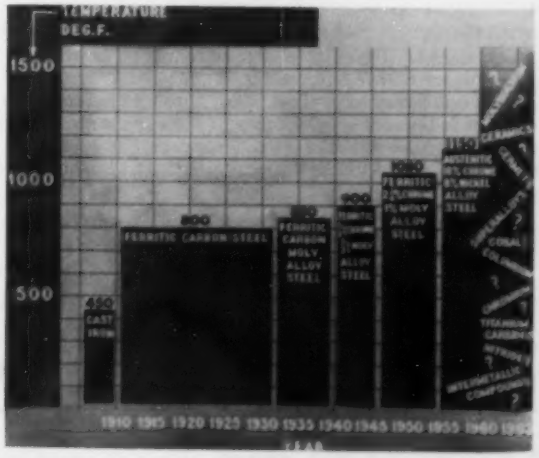
8. High pressure and temperature boiler, and reheater. Steam supply is from a 150,000-lb-per-hr, 1,500-psi, 850F boiler. A separate oil-fired superheater is capable of raising 100,000 lb of steam per hr to 1,100F.



VIBRATION in spindle is induced by vibration exciter and measured by a probe. Set-up is on seismic mass to isolate external vibration

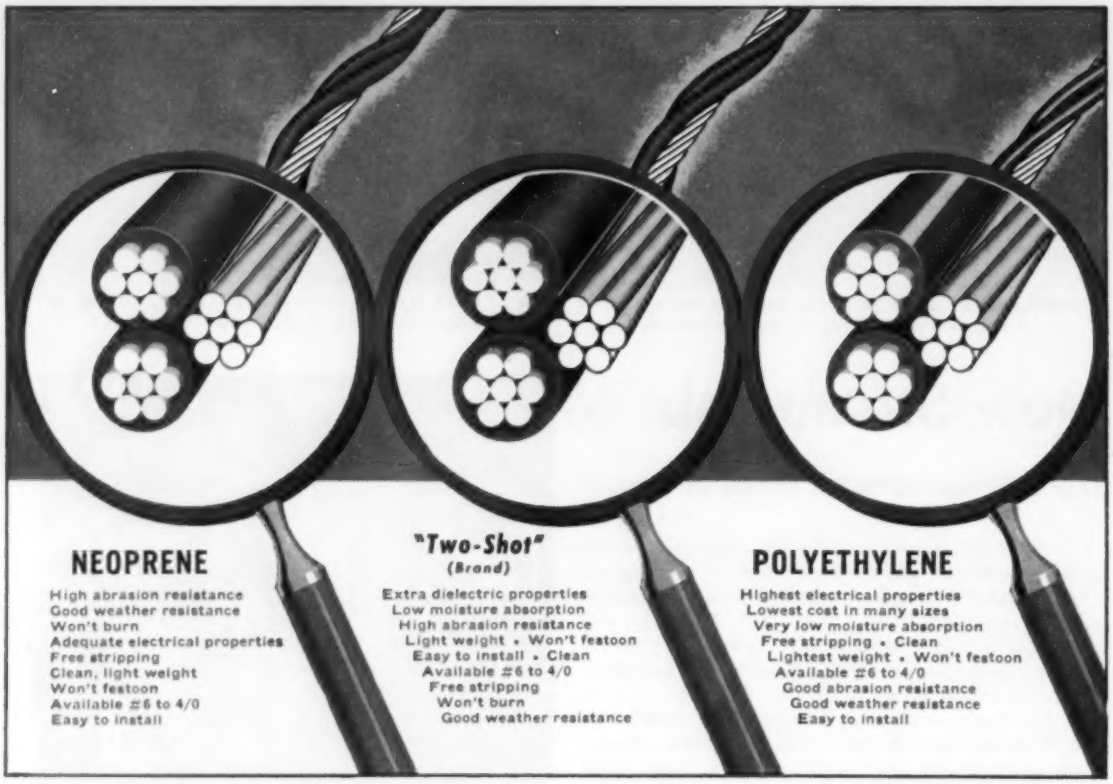


STEAM CYCLE PROGRESS shows incremental gain in efficiency. Higher steam conditions are desired for further gains in efficiency



METALS in steam turbine casings were changed over the years to meet requirements as the inlet steam temperature was pushed upward

Choose your service drops from the K/W. TRIPLEX TRIO



YOUR CHOICE of service drop insulation is readily available in Kaiser Aluminum's K/W Triplex Trio.

Whether you prefer Neoprene or "Two-Shot" or Polyethylene, you can specify K/W with full confidence of getting the highest quality materials to meet your needs.

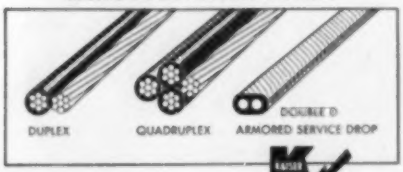
For example, if you want a premium-type product, you can order K/W's long-accepted "Two-Shot" Triplex at slight additional cost. The phase wire insulation—a 2/64" inner layer of special rubber (3/64" on stranded wire) with 2/64" jacket of tough Neoprene. "Two-Shot" Triplex provides added dielectric properties and weather resistance.

Otherwise you can specify regular K/W Neoprene or Polyethylene insulated Triplex or covered line wire for open wire services. No matter which conductor you choose, you are assured of long trouble-free service when you use Kaiser Wire.

If your services go through trees, ask your Kaiser Aluminum conductor engineer for advice on suppliers of economical tree guards, or you may want to consider a new Kaiser Aluminum development—"Double D Armored SD."

For complete information on Kaiser Aluminum conductors, contact our sales office listed in your telephone directory or one of our many distributors. Kaiser Aluminum & Chemical Sales, Inc., *General Sales Office*, Palmolive Bldg., Chicago 11, Ill.; *Executive Office*, Kaiser Bldg., Oakland 12, Calif.

ADDITIONAL SERVICE DROP PRODUCTS



Kaiser Aluminum

THE NATION'S LARGEST PRODUCER OF TRIPLEX AND ALUMINUM WEATHERPROOF CONDUCTOR

POLYETHYLENE & NEOPRENE WEATHERPROOF AND TRIPLEX • QUADRUPLEX • ACSR ALL ALUMINUM CONDUCTOR • RECTANGULAR, SOLID ROUND AND TUBULAR BUS

REA Reports on '54:

- **Loans at highest level since 1951**
- **Electric construction declines**
- **New procedures aid borrowers**

Rural Electrification Administration loans during 1954 totaled $241.8 million, the highest since 1951, according to REA's summary of its activities for the year.

Here are some of the highlights contained in an annual report REA will submit to Congress soon:

• Electrification loans to 325 borrowers totaled $167,104,000. This was about $2 million higher than either 1952 or 1953 volume. Cumulative total electric loans rose to $2,885,-932,099.

• Telephone construction showed a marked increase, but electric borrowers' building continued to decline. Nevertheless, borrowers placed in service about 140,000 kw of additional generating capacity, bringing the total installed capacity of REA-financed plants to approximately 815,-000 kw. They energized about 4,800 miles of transmission line, bringing the total transmission line in service to about 25,000 miles.

Generation and transmission accounted for about one-fifth of the total amount loaned.

• REA adopted a shortened procedure for loan screening, under which applicants who have proved themselves sound business enterprises are given short checks. Under this procedure, which began Feb. 3, 1954, 55 loans were made for more than $20 million up until June 30, 1954. REA said this was a prime factor in enabling it to reduce its loan backlog to $118 million, the lowest fiscal year-end level in recent years.

• Emphasis was placed on borrowers whose operations indicated they would face financial difficulties when debt payments increase. About three-fourths of borrowers with loan security problems improved their position.

• REA administrative expenses were cut about 9%. To do this, the agency shifted responsibility to borrowers for obtaining audits and engineering inspection, and by cutting administrative functions.

Towers Erected to Carry Shepaug Power

Steel tower has been erected to carry power from Connecticut Light & Power Co's Shepaug hydroelectric project which is scheduled to be completed this fall. The tower is one of two recently completed and awaiting stringing of power lines which will carry electricity from the dam.

Work is continuing on the 1,412 ft dam and the bus yard. Installation of powerhouse equipment is now being undertaken. The project will produce about 117 million kwhr a year.

• It became clear that the Bureau of Reclamation will not be able to supply increasing needs of REA systems in the Missouri River Basin and that additional sources would have to be obtained. Studies are underway in the Western Division involving construction of an REA-financed generating plant to feed into the bureau's system. No conclusions have yet been reached on the Eastern Division.

• The agency issued standards for steam generating plant components, connectors, and related items.

• It found an abnormal number of pole failures during the year, principally among those made during 1946-50.

• It revised its system design study method. The revision requires an economic study of alternate designs, including initial cost of construction and annual operation-maintenance costs.

Bids for Oroville Power

Pacific Gas & Electric Co has offered to pay State of California 8 mills per kwhr for power generated at Oroville Dam, part of the proposed $1.2 billion Feather River Project in northern California. State has estimated it will gross $13.5 million a year on Oroville power sales. But, upon completion of project 40 years hence, the state will have to buy $45.8 million worth of power a year to operate water pumps for a series of canals to southern California.

Super power transformers pace utility expansion

New Era in Power Transmission

THIS 230,000-volt, 150,000-kva power transformer was built by Allis-Chalmers for Duke Power, to be installed at Riverbend steam station near Mt. Holly, North Carolina. It is believed to be the highest kva transformer ever put into service in the 230,000-volt class.

Records are being broken almost monthly as larger and larger power transformers are shipped by Allis-Chalmers to utility installations all over the country. For example, the highest voltage transformers ever ordered in the United States are now being built by Allis-Chalmers. These will be 345,000-volt, 200,000-kva single-phase units that will form the largest bank ever built — a total of 600,000 kva. They will be shipped at the end of this year.

Allis-Chalmers is becoming the overwhelming choice to help utilities break the barriers of high voltage transmission with larger and larger transformers. Here are some of the reasons why:

- *Allis-Chalmers pioneered the development of corona-free design.* Result: Possibility of insulation damage that previously made such large transformers difficult to design is completely eliminated. Buyers are assured maximum transformer life with no danger that corona will cause insulation breakdown.

- *Allis-Chalmers last year successfully produced the highest voltage commercial-type transformer ever built.* The 600,000-volt unit gives utilities a proved means for lifting voltage horizons even farther. It produced data which show the practicality of designs for power transformers for 880,000-volt transmission.

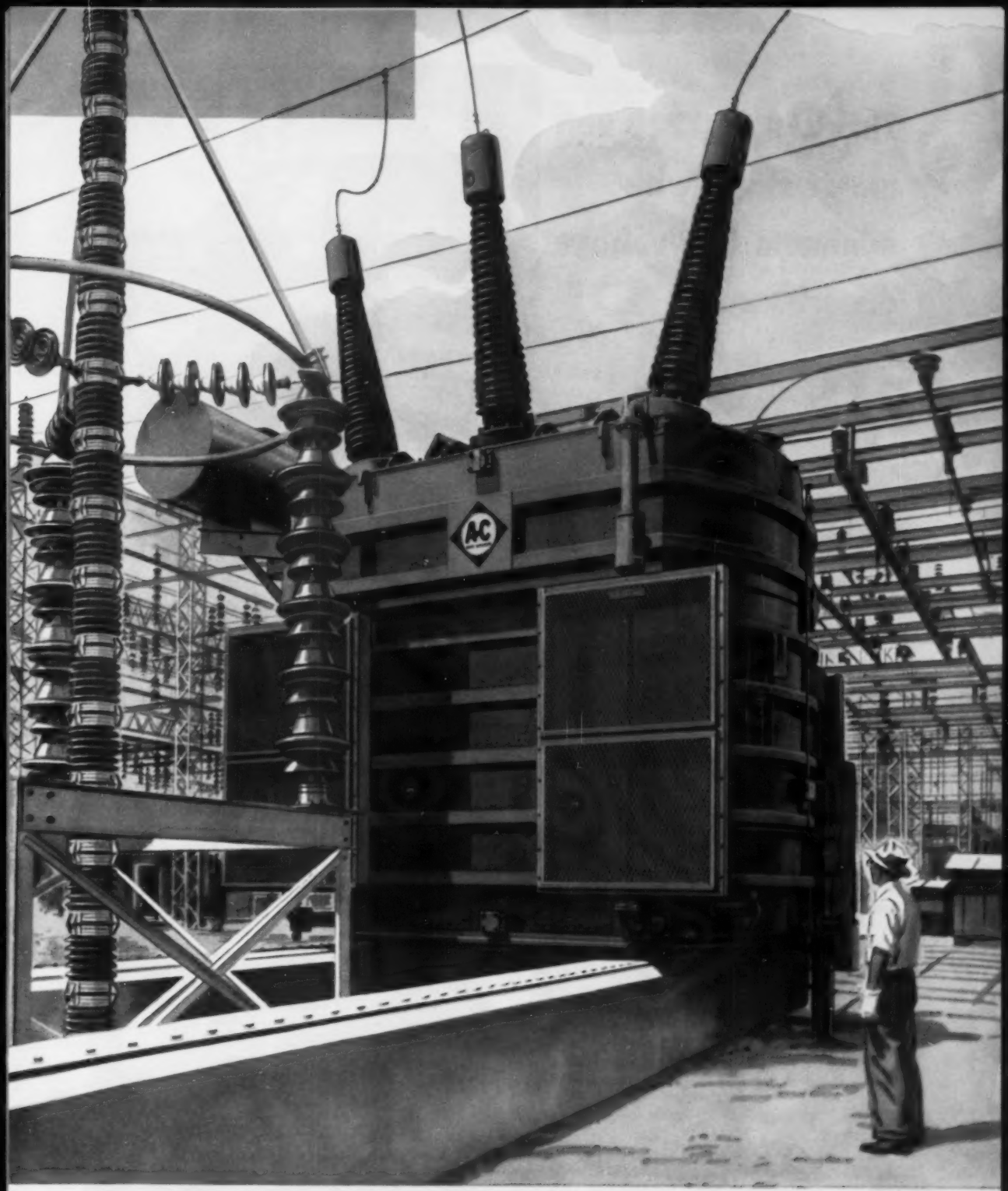
- *Allis-Chalmers successfully adapted welding techniques to make possible the use of heavy plate aluminum in transformer core and coil construction.* As a result, transformers are lighter in weight, can be built in larger sizes, and can be more easily shipped and installed.

An Allis-Chalmers representative will be glad to discuss transformer developments with you at your convenience. Call the nearby A-C office or write Allis-Chalmers, Milwaukee 1, Wis.

A-4573

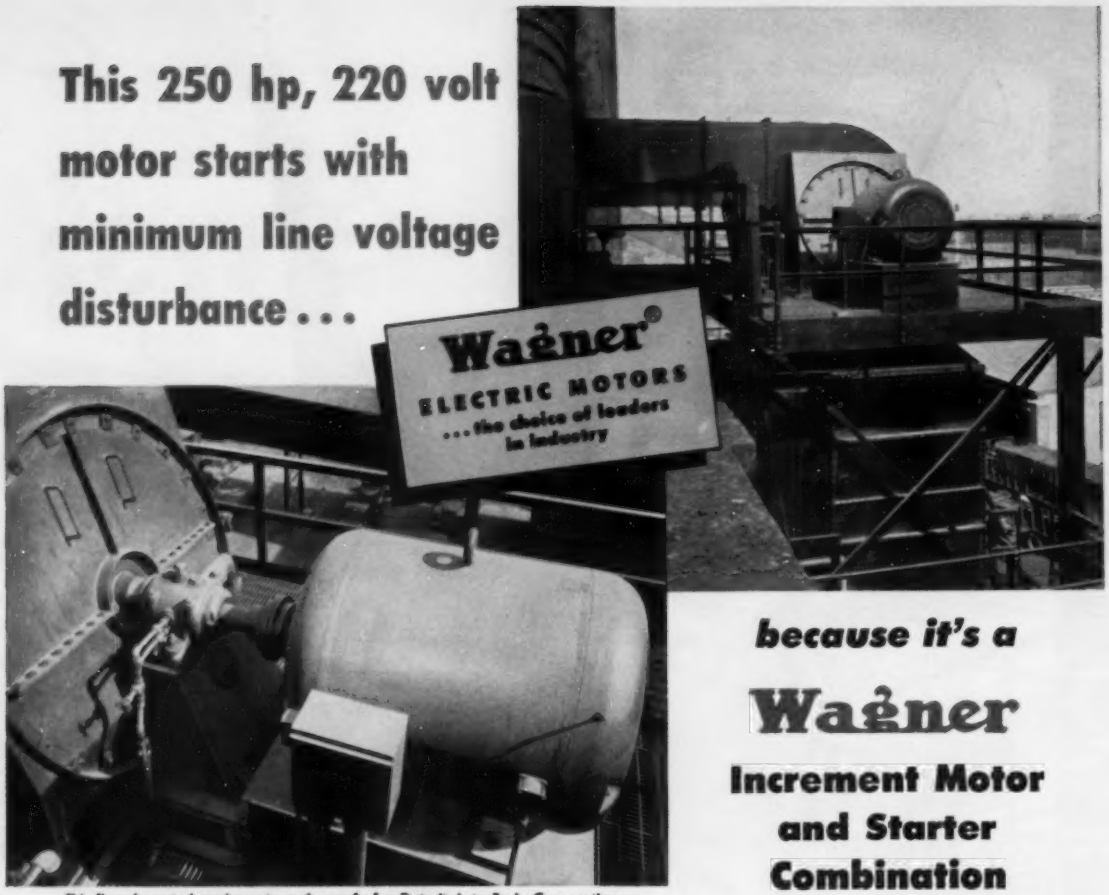
A-C ALLIS-CHALMERS

ALLIS-



CHALMERS

This 250 hp, 220 volt motor starts with minimum line voltage disturbance . . .



This fly ash control equipment, on the roof of a Detroit Auto Body Corporation, is powered by a 250 hp, 220 volt, 1160 rpm, totally-enclosed Wagner motor.

because it's a

Wagner

Increment Motor and Starter Combination

Power Companies and their customers *both* benefit when the Wagner Increment Motor and Starter Combination is put on the line because this combination provides an economical yet highly satisfactory method of starting large polyphase squirrel-cage motors in any application where reduced current draw at start is required. No auto-transformers or resistors are necessary.

Voltage disturbances on the line are reduced because the current taken from the line is not broken during the starting period—as happens when auto-transformers or compensator-type starters are used.

Wagner Electric's successful experience in applying its increment motor and starter combination *as a package* for more than fifteen years is your assurance that power company rules will be met. There is no question of divided responsibility as is the case when motor and increment type starter are purchased separately. Their steadily growing acceptance and popularity is proof of their efficiency and dependability.

Wagner two-step motor-starter combinations are suitable for most applications. Three-step, four-step, and five-step motor-starter combinations are available for installations calling for unusually low inrush of starting current or for other special applications.

Wagner Bulletins MU-128 and MU-195 give full information. Send for your copies today.

Wagner Electric Corporation
EST. 1891

WAGNER ELECTRIC CORPORATION
6456 Plymouth Ave. • St. Louis 14, Mo., U. S. A.
ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS — AIR AND HYDRAULIC
BRANCHES IN 32 PRINCIPAL CITIES

M55-10

"Closed for the season" signs are tossed away when . . .

Electric Heating Goes to the Outdoor Movies

H. D. RANDOLPH, Electric Heating Representative, Toledo Edison Co, Toledo, Ohio

"Closed for the season" signs have been tossed in the ashcan at one Toledo, Ohio, outdoor theatre. Electric heaters are warming patron's cars and keeping box office receipts hot throughout the winter at the Miracle Mile drive-in theatre in that city.

Opened last fall, Miracle Mile, when fully completed, will be able to accommodate 1,870 cars with heating facilities to serve every one of them.

ELECTRIC HEATERS, plugged into receptacles on speaker posts, operate at 120 v from 3-phase, 4-wire secondaries. Author, center, discusses the installation with theatre owner and equipment dealer

The heaters, 600-w units equipped with 40-w fan motors, are supplied from plug-in receptacles mounted to the theatre's speaker posts. Both the heater and the outlet are fused. Heater operates inside the car with cord extending out a window or under the car door to the plug-in receptacle.

Units operate at 120 v from three-phase, four-wire, 120/208-v, 60-cps secondaries. Buried cables form the secondary mains which extend along the edge of the parking area. They are supplied from five banks of three 25-kva transformers each, installed on five poles along the theatre property boundary. Service is primary metered. Each transformer bank (75-kva) serves three car ramps. Load on each bank is approximately 100 kva.

The secondaries extend down each pole to a 200-amp fused switch, and the service goes from these switches to the underground circuits supplying the heaters. The service lines extend the three phases along each row of speaker posts. Load is balanced on phases by connecting every third speaker post to a phase.

Heating is only part of this drive-in theatre's total electric load. Some 80 kw in commercial cooking equipment provides food service for up to 3,800 persons per hour at Miracle Mile's four cafeteria-style counters.

The ticket gate, screen, concession stand and projection booth add another 200 kw. They are served by a bank of three 37½-kva transformers. From the transformer pole, an underground service extends to the ticket gate house terminating in a 600-amp switch and secondary metering. Three 4-wire, 4/0 circuits extend underground from the metering to 200-amp switches at the screen, projection booth and concession stand.

At the theatre entrance, ticket booths are electrically heated. There is also an elaborate traffic control system for stop and go car signals, call lights for theatre personnel and fence lighting—an additional load of 20 kw.

Ohio Brass Adds New Bushings

A new line of ASA standard bushings is now in full commercial production by Ohio Brass Co, Mansfield, Ohio. Years of research, new buildings and machinery involving over a million-dollar investment, organization of manufacturing and assembly processes—all are involved in the production of the new design of transformer and circuit breaker bushings for the range from 23 to 69 kv. Designs are being completed for higher voltages to span all voltage requirements for the electric power industry.

Left to right are T. F. Brandt, development engineer, W. M. Marr, factory manager, and G. V. Smith, equipment division sales manager, giving a version of the triple-play combination—in this case, from Engineering to Production to Sales. In the background, equally happy to have the new bushing ready for market is W. H. Burleson, manager of power utilities sales.

Electrical Imports Alarm Canada

As a direct result of foreign imports, Canada's third largest industry —electrical manufacturing—is facing a serious recession, according to an independent economic report on the state of the industry, released recently.

The 100-page report represents some eight months work by Prof F. A. Knox of the Department of Political and Economic Science at Queen's University, with the assistance of Prof C. L. Barber of the University of Manitoba, and Prof D. W. Slater, also of Queen's University, Kingston, Ont.

The report is the result of a request by the Canadian Electrical Manufacturers Association to determine the true facts about the productivity of the industry and the impact of foreign competition. It shows:

1. Canada's electrical manufacturing industry is faced with serious problems of readjustment, falling income, declining production and growing unemployment, as a direct result of foreign imports.

2. Devaluation in foreign currencies and the increase in the Canadian dollar have all but wiped out the advantages of Canadian tariffs on electrical goods.

3. Electrical manufacturing is definitely not a "high cost industry." The more the industry is squeezed by operating costs, the higher its prices must go.

4. Costs of important raw materials, machinery and equipment used in electrical manufacturing are higher in Canada than in the U. S. or western Europe.

5. In its attempt to compete for Canadian labor with other high wage extractive industries, the electrical manufacturing industry's wage rates have increased faster than those in any other competing country.

6. The electrical manufacturing industry is not lacking in productivity. It is one of Canada's most strategic industries.

7. As a result of quantitative and currency restrictions imposed by other nations, the Canadian industry has not been able to sell its products abroad.

Imports Up 140%. In his report, Prof Knox further showed that from 1950 through 1953, total imports of electrical equipment increased 140% from $116,200,000 to $281,700,000. In 1948, electrical imports took 15.4% of the Canadian market. By 1953, this had risen to 23.7% the highest level since 1929.

During 1954, import competition maintained its 1953 level, but the Canadian market for electrical goods declined, causing unemployment and loss of income in Canadian industry.

According to Prof Knox and his associates, the increase in labor rates is one of the most serious problems affecting the competitive position of Canada's electrical manufacturing industry.

From 1939 to 1952, comparative increases in electrical manufacturing wage rates were: Canada 223.2%, U. S. 152.8%, U-K 103.5%, Germany 19.4%.

In addition to the cost-squeeze caused by advancing wage rates, the industry has been further harassed by the lowering of Canadian tariffs. Average tariff protection afforded the industry is now less than at any time during the past 75 years.

Currently, imports of many types of electrical goods are subject to a tariff of 22½% under the most-favored-nation schedule, and a tariff of 15% under the British preferential schedule. However, the increase in value of the Canadian dollar and devaluation of foreign currencies have almost wiped out these tariff advantages, and given foreign manufacturers a very substantial trade advantage.

Commenting on this, Prof Knox states that "it is now possible for a British manufacturer incurring the sterling equivalent of a Canadian dollar's worth of wage costs to cover

(*Continued on page* 59)

Type No. 301
Triangular Structure*

LIST OF MATERIALS

Quantity	Description
1	Crossarm
1 pr.	Wood crossarm brace
3	Pin-type insulator
1	Ridge iron, single
1	Crossarm pin, short shank
2	Crossarm pin, long shank w/saddle
2	Flanged washer 3" sq. x 3/16", ¾" top
4	Machine bolt ⅝"
2	Curved washer 2½" sq. x 3/16", 11/16" hole
1	Spring washer
3	MF locknut ⅝"

A Supply Service Geared to your needs

From the top of the pole to the bottom of the hole, Graybar offers you efficient flexible procurement of *all* the electrical supplies and equipment you need for pole-line construction or maintenance.

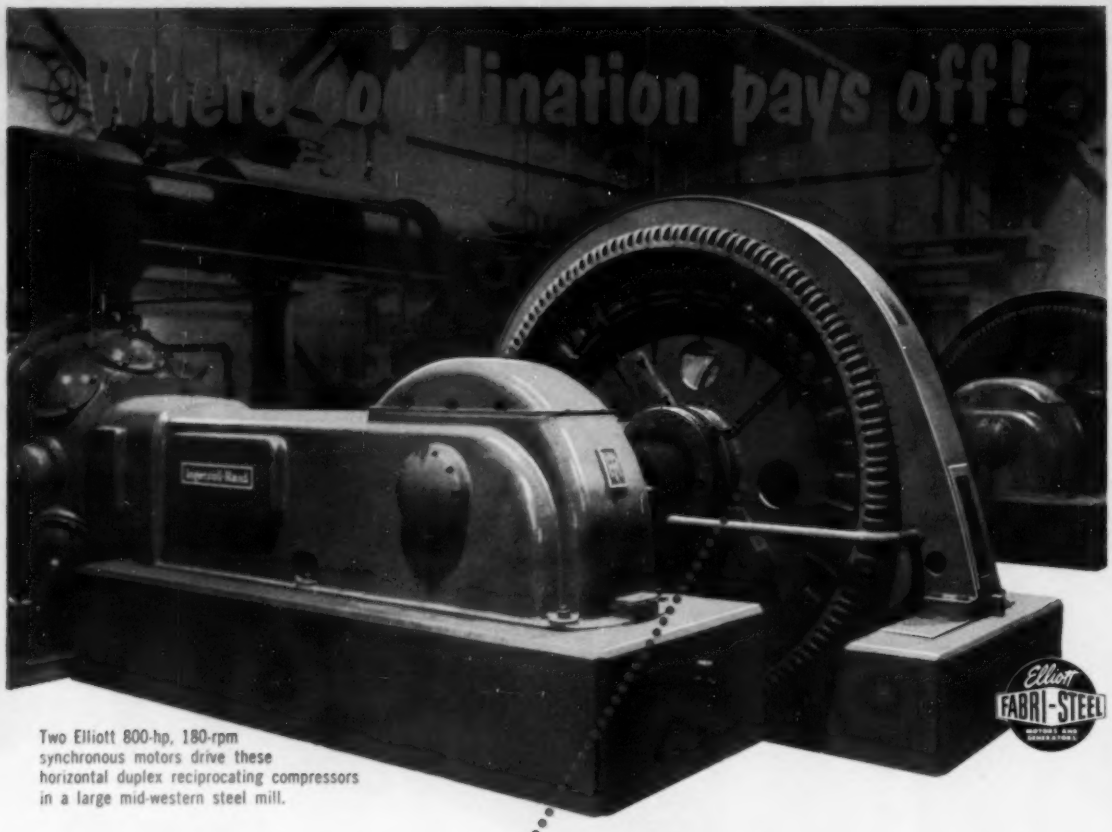
For one unit . . . or a thousand, the complete list of materials for the structure at left can be ordered together — from your nearby Graybar office or warehouse. For many structure types, we can also supply completely prebored and prefitted crossarm and hardware assemblies. Discuss your needs with a Graybar Outside Construction Specialist — he's experienced at gearing our service to utility needs. His friendly understanding of your problems is the result of Graybar's years of association with the utility industry.

Make it a point to call Graybar *first* — you can be sure your needs will be understood and accurately met. *Graybar Electric Company, Inc. Executive Offices: Graybar Building, 420 Lexington Avenue, New York 17, N. Y.*

389-92

CALL GRAYBAR FIRST FOR... Everything Electrical

IN OVER 100 PRINCIPAL CITIES



Two Elliott 800-hp, 180-rpm synchronous motors drive these horizontal duplex reciprocating compressors in a large mid-western steel mill.

ELLIOTT SYNCHRONOUS MOTORS

Engine-type rotors can be split (hub and rim) or the hub only may be split. Balance rings can be added when additional inertia is necessary.

team up perfectly with compressors to assure top operating efficiencies. This teamwork is no accident. The complexities of compressor drives require the most careful engineering design and compressor application experience. Elliott has this background as attested by hundreds of successful installations. Such factors as starting torque and current, suitable flywheel effect, as well as power factor correction, are carefully analyzed. The result is the kind of performance that has earned a reputation for Elliott in large synchronous motor compressor drives. Contact your nearest Elliott Field Engineer for full details or write Elliott Company, Ridgway, Pa., for Bulletin PB 5000.

ELLIOTT Company

B5-4

Electric Imports

(*Continued from page 56*)

that cost by receiving 56 Canadian cents. The Canadian manufacturer must still get $1.00."

Aids U. S. Also. This advantage also applies to U. S. manufacturers, Prof Knox pointed out. Depreciation of the American dollar has improved "the competitive position of the American electrical producer of electrical goods in the ratio of 100 to 85, or 18%."

The Knox report also found that the Canadian electrical manufacturer is also at a disadvantage when it comes to capital costs for plant construction and improvement.

Cost of new machinery for electrical manufacturing is about 10% higher in Canada than in the U. S.

Holds Volume Down. As a result, states Prof Knox, "the volume of output of Canadian plants may not be sufficient to secure economies of a scale equivalent to that obtained by American producers, and for these parts of the industry (larger appliances and industrial apparatus), tariff protection is essential to their continued existence."

Nor has the Canadian electrical manufacturing industry been able to offset encroachment of foreign imports through exports. Prof Knox shows that because of quantitative and currency restrictions in other countries, the industry's exports in 1953 dropped to 1.1% of total industry production.

Westinghouse Announces Policy Change on Oils

Westinghouse Electric Corp has announced a new policy regarding purchase of replacement insulating oils used in oil-insulated apparatus such as transformers, regulators, and circuit breakers. The policy change means that:

1. Effective midnight June 30, 1955, users of Westinghouse oil-insulated apparatus can purchase replacement oils either direct from Westinghouse, as in the past, or from any Westinghouse-approved-brand supplier.

2. Westinghouse-approved-brand insulating oils can be used in any combination of mixtures regardless of supplier, since the oils will all comply with Westinghouse insulating oil specifications.

3. The company will continue to ship new oil-insulated apparatus with Wemco "C" or "CI" insulating oils—composed of Westinghouse-approved-brand oils—in accordance with present practices.

4. Westinghouse oil-insulated apparatus is to be operated only with Westinghouse-approved insulating oils. When this apparatus is operated with other than Westinghouse-approved oils, the standard warranty is void in case of trouble traceable to oil.

Purple Lake Project Contracts Awarded

The Metlakatla Indian Community of Alaska has awarded three power equipment contracts totaling more than $67,000 in connection with its Purple Lake hydroelectric project.

Westinghouse Electric Supply Co. will furnish indoor metal-clad switchgear for $36,190; Wagner Electric Co. will provide four 1,250-kva outdoor-type power transformers for $20,808; and Allis-Chalmers Manufacturing Co. will furnish a substation structure and switching devices for $10,584.

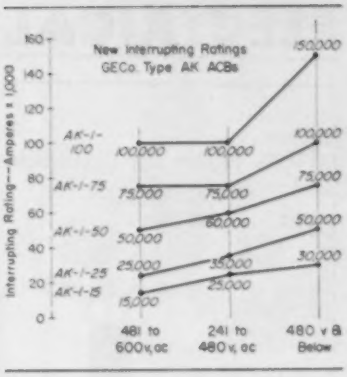
Construction has been shut down until spring, after completion of a half-mile tunnel to the headshaft at Purple Lake.

MANUFACTURING BRIEFS

Hubbard & Co, Pittsburgh, Pa, has purchased the pole line hardware operations of the Locke Insulator Dept of General Electric Co at Baltimore, Md. (EW, Feb. 21, p 178).

International Business Machines has an "electronic supervisor" that follows preset programs and automatically switches on and off up to 40 groups of remote operations. The system uses carrier current signals over existing electrical circuits.

Arvin Industries, Inc of Columbus, Ind, has formed an electronics products division to specialize in industrial and military projects. Leo W. Burns is general sales manager.



I-C Ratings Hiked on GE L-V Magnetic Air Breakers

Significant savings in switchgear will result for customers purchasing equipment with magnetic air circuit breakers to be applied on circuits of 120/208, 240 and 480 v ac. This is a direct result of the increase in interrupting ratings on the complete line of General Electric AK line of air circuit breakers. The chart shows this significant increase from 25% to 50% for voltages of 480 and below.

This increase in ratings is very timely because electrical systems are expanding in industrial plants and commercial buildings. Over 90% of all breakers are applied in these locations at 480 v and below.

This increase in interrupting ratings is possible since tests in the Switchgear Development Laboratory have shown that the efficient G-E multi-slot interrupter is capable of interrupting high currents at 120/208, 240 and 480 v ac.

The graph shows a quick reference table for the new breaker interrupter ratings.

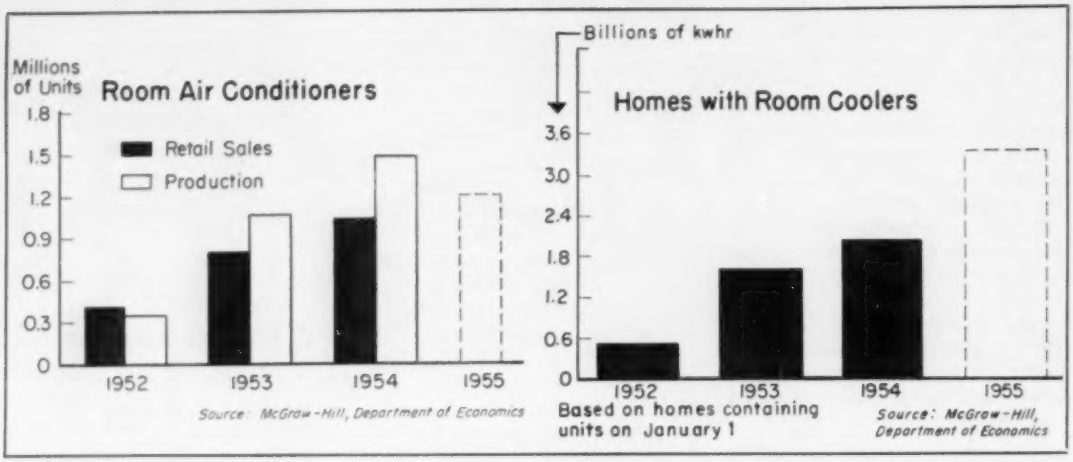
No change is being made in the ratings at 600 v ac and 250 v dc. The short-time, the close-and-latch ratings and continuous current ratings remain unchanged.

The actual benefits to a customer are:

1. A considerable reduction in price for breakers applied in cascade under the new ratings as compared to the former ratings. In a typical 1,000 kva load center unit, savings of approximately 27% on the switchgear part are possible.

2. The advantage of a better system using fully rated breakers is possible with the increased interrupting ratings —at approximately the same price as the former cascade arrangement.

ELECTRICAL BUSINESS OUTLOOK



Room Cooler Gains Seen Continuing

This time of year, when the air is still being cooled naturally, is a good time to study the room cooling business. Later on, both the air and the air conditioning business generally get too hot for thinking.

It's a good bet that this will be another good year for sales of room coolers. Both personal and business incomes will be higher. People seem willing to spend their money. And, with room coolers now installed in only about 4.5% of the nation's wired homes, the market for artificially cooler summers is broad and promising.

But it's also a good bet that this will be another disappointing year for many people connected with the home air conditioning business. The reason is that they have set their sights too high—and some of them still seem to expect sales to drop into their laps in ever-increasing numbers, regardless of other factors.

Industry Overproduced In 1954 . . . Last year was one of these paradoxical years—a year of rising sales for room coolers, but also a disappointing year for some people dealing with them. Retail sales of coolers in 1954 rose by about 25%—a striking increase for any business, and a phenomenal one for a recession year. Roughly 1 million sets apparently were disposed of at retail last year.

But the industry, fired up with enthusiasm for its "growth product," made somewhere in the neighborhood of 1.5-1.6 million coolers. Manufacturers and dealers were left with unsold inventories that probably are well over half a million sets.

This kind of overproduction makes life tough for everyone in the business—from the manufacturer down to the utility that is planning load growth and perhaps helping sell room cooling. It results from:

Too much optimism—the idea that a product is going to go on doubling sales every year, just because it starts out that way. But it never does.

Too many producers—people who are attracted by the product's growth prospects, but are not equipped to stay in for the long, hard pull. In the short run, this means cutthroat competition among manufacturers and retailers and takes a lot of the profit out of the product.

As for 1955, there is every reason to expect sales of room coolers to rise again this year. Sales may go to 1.2-1.3 million. At 1000 kwhr per set, that means a substantial increase in load for utilities with a lot of residential customers, even though it may fall short of some of the big things expected.

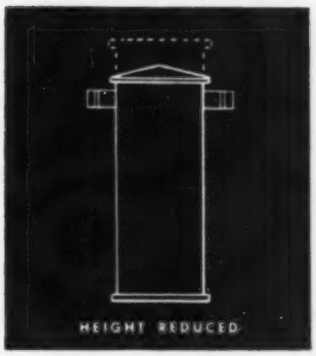
Competition Seen Tougher This Year . . . Room cooler sales will run into a couple of problems this summer that may eat into sales. For instance, even "growth" products have to compete with other products for the consumer dollar. This year there will be plenty of competition, not only from other appliances but also from automobiles. Detroit is in an all-out campaign of auto selling. Chances are that quite a few nest eggs that were supposed to purchase a room cooler will wind up as the down payment on a new car in 1955.

The other problem is full-scale air conditioning. It has been fairly slow to get established in new homes north of the Mason-Dixon line. But it will be pushed hard this year.

But coolers should be able to show another 20-25% gain in spite of all this. The one problem they can't beat is the weather. About two-thirds of room coolers are sold in the three hot summer months. If they are not hot enough, it's just too bad.

J. W. Durkin, Distribution Transformer Specialist, explains this

FACT: Reduced height simplifies change-outs . . . saves money . . . meets EEI-NEMA standards



The new Westinghouse pole-type distribution transformers in the wall-mounted bushing design, 25 to 50 kva, are the shortest in the industry—*and still meet EEI-NEMA standards.* This height reduction—made possible by compact core-coil assembly design and most practical location of hanger lugs—represents real savings to utilities: existing "joint use" poles can be used when changing to higher ratings.

It's additional proof that your transformer dollar is worth more with Westinghouse.

• • •

Get all the facts from The Man With The Facts—your Westinghouse Sales Engineer. Or write to Westinghouse Electric Corporation, 3 Gateway Center, P. O. Box 868, Pittsburgh 30, Pa. J-70738

YOU CAN BE SURE...IF IT'S

Westinghouse

PANEL on increasing percent return includes these Middle West Service Co executives: J. S. Hartt, left, chairman of executive committee; Pres Edwin Vennard; VP R. McClanahan

M. R. RODGER advocates scientific sales program to increase the percent return

Rate of Return Can Be Increased

Selective selling, reduced operating expenses, interconnections, and adjusted and redesigned rates are advised at conference run by Middle West Service Co

Methods for increasing percent return on utility investment by as much as one full percentage point occupied the attention of about 100 utility and manufacturing representatives who gathered, Feb. 14-16, at Biloxi, Miss.

Middle West Service Co arranged the meeting. Pres Edwin Vennard led the sessions and presented speakers from Continental National Bank & Trust Co, Opinion Research Corp, Westinghouse Electric Corp, General Electric Co, and his staff.

Program Had Pattern . . . Formal papers and resulting discussions highlighted four major lines of attack:

1. Get better utilization of existing investment by selective selling to improve load factor.

2. Reduce operating expenses by modernization and electric automation of clerical and accounting procedures, careful system planning to obtain lowest power production and transmission costs, and improved personnel methods and continuous management inventory of key personnel.

3. Analyze carefully the available and potential economies of pooling with neighboring companies.

4. Redesign and adjust rates to obtain bottom steps that are compensatory for all added energy sales.

The index of efficient utility operation is percent return on investment, Vennard asserted. Increased revenues and kilowatt-hour sales, even increased net income, can all be deceptive if not related to the invested capital of the enterprise. Percent return takes into account all of the variables and furnishes one inclusive and reliable index.

Consideration of percent return should not be reserved for rate cases. The entire operating staff of the utility should be encouraged to think in terms of percent return in all operating matters. We cannot count upon increased sales volume alone to improve our position. We need to know more about the economics of the power business.

Scientific Sales Program Needed . . . M. R. Rodger, senior sales consultant, Middle West Service, advocated development of a scientific sales program to increase percent return. Such a program would involve study of appliance saturation, development of load curves five years in advance, and an estimation of percent return on investment required to serve major appliances.

He advised putting into effect a sales program to push appliances which offer the best opportunity to improve the over-all system load factor and at the same time to earn a good rate of return on the added investment needed to serve them.

Construction Costs Always Go Up . . . Today, with improved cost indexes and property records, we can make a valuation from indexing that is far more accurate, much faster, and less costly than the older methods of physical count and inspection for evaluating utility property. Jay Samuel Hartt, chairman of the executive committee of Middle West, further explained: The method has been accepted by courts and commissions as being preferable to the other methods. Adjustments can be and are regularly made for area differences in construction costs. Separate indexes have been developed to allow for such regional characteristics. As a consequence, the valuation accurately reflects the regional differences in cost.

The development of these indexing methods has revealed that utility construction costs seldom decline very much. The long time trend has been steadily upward. There is little reason

to anticipate any reduction in such costs in excess of 10% during the next 25 to 50 years.

William Parkerson, rate consultant, Middle West, advised that with proper rate design it is possible to provide a residential demand feature that is liked and not disliked by the customer. To do this, it is necessary to give a discount for a good load factor instead of a penalty for a poor one.

Electric peaks have kept growing through booms, wars, and recessions at a more or less compound rate, stated J. Van Rysselberge, Middle West's economic consultant. This pattern has been so consistent for so long that the trend cannot be safely disregarded when exercising judgment on probable future trends. The larger the operations with which one deals, the more clearly the compound nature of the trend appears.

Innovations such as refrigeration, radio, television, and air conditioning each contributes its unexpected portion during the early years of saturation. It is these successive innovations combined with population growth and increased industrial use of power which maintain the compound trend.

Air Conditioning Pushing South . . . It is unlikely that air conditioning will lift the peak for the country as a whole above the long-time trend. But companies in the South may find their peaks being pushed above their long-time trends. Companies in such areas might well adopt the sharpest compound trend of peaks of the last five years or so to reflect the spurt in air conditioning.

R. McClanahan, executive vice president, Middle West, stated that as utility companies have grown the paper work and volume of clerical transactions per dollar of revenue have materially increased. To reduce this and obtain economies in accounting, office, and operating procedures three important changes have taken place already in accounting methods and procedures:

1. Automation of various degrees, dependent upon the type and use of mechanical accounting equipment.

2. Centralization of accounting.

3. Elimination of a substantial portion of reporting and accounting by areas, divisions, or districts.

To obtain further economies the forthcoming developments of the near future will be the automatic office as the result of electronic accounting and centralization of receivables.

Budget For Profit . . . Budgeting should be called "Profit Planning" if the budget does what it is supposed to do, said C. V. Dinges, Jr, treasurer, Middle West. Under responsibility accounting a budget gives the operator a definite yardstick with which to measure his effectiveness. It is free from the cloudiness that comes with trending costs which include many allocations over which the operating man has no direct control.

In his talk Harry V. Plate, Middle West vice president, said:

We strongly advocate careful and continuous studies to develop a long range system plan. Load projections should extend at least ten years into the future. The purpose of such a program is to gain the economy that comes from being able to do the right thing at the right time in the construction of generating facilities and transmission capacity.

People Are Getting Attention . . . Robb Winsborough, personnel consultant, Middle West, declared that utility managements are beginning to pay as much attention to people as they have been paying to construction, financing, and accounting.

The technique of opinion measurement has made it possible to be objective about public relations and employee relations. It is possible to measure the status of a utility's public relations and also the attitude of the employees toward the management. Alert managements are doing this and then setting up comprehensive programs to correct the weaknesses that are revealed. These programs can be very effective.

TECHNICAL NOTES

The automatic industrial plant of 1964 must have a 1964 model power systems.

Secondary capacitors are a bonanza to an underground distribution system afflicted with low power factor loads.

Inductance measured with a sine-wave audio oscillator can locate a low resistance fault on cable provided constants for cable prior to fault are known.

Time switching of capacitor breakers limits number of operations and holds capacitors in service during load peak despite local voltage conditions.

Grounding by means of ground conductor in weatherproof connection cable is mandatory for each trailer in a proposed new code for electrified trailer camps.

Savings of open-delta transformers for combined light and power pick up a $100 increment where space savings eliminate a pole changeout.

Manpower with suitable skills and training is an important adjunct of system planning.

Wave shape of transmitter supply voltage is investigated by some telecasters.

Secondary capacitor economics are simplified if their cost added to that of the distribution transformer they supplement is compared with cost of a larger transformer capable of serving the same load without capacitors.

Scotch Tape can be used to test adhesion of silver plating on electrical conductors. Plating pulls off if not properly applied.

Voltage balance may improve when a secondary capacitor shunts open leg of open-delta transformer bank. But voltage soars dangerously when one transformer fuse blows.

Primary circuit costs can be cut by open-delta 3-ph connections but current in the Y neutral boosts line losses.

NRECA Meeting

(*Continued from page 10*)

REA co-ops will be able to move into the atomic age just as soon as it makes economic sense to do so," he said.

Nelsen also urged the co-ops to give more consideration to interconnections and integrations with private companies to provide a "better power rate to the farmer." He cited the East Kentucky Rural Electric Co-op interconnection agreement with Kentucky Utilities Co, and cases in other states, where substantial savings to the co-ops had been achieved in this manner.

Noting that the rural electrification program was free enterprise, Nelsen cautioned the co-ops to remember "that there are others who have invested their savings and facilities who also deserve tolerant consideration on our part."

Sen Albert Gore (D-Tenn.) urged that AEC promptly construct a nuclear power reactor to generate electricity in "substantial quantity." He said, "We cannot afford to rely upon the Dixon-Yates type of guaranteed private enterprise to provide healthy competition necessary to insure availability of atomic power to the people of our nation."

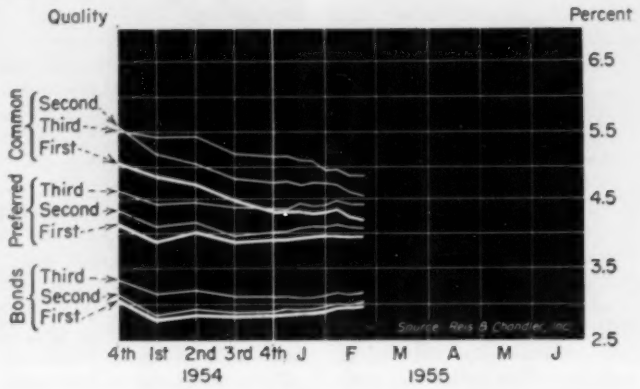
Sen Richard L. Neuberger (D-Ore.) attacked the Administration's "partnership" policy. This policy, said he, is one "in which the government relinquishes to private monopolies the powerhouses at federal dams, while the government continues to finance the nonreimbursable features such as fish ladders, flood gates, and navigation locks."

Rep H. R. Gross (R-Iowa) compared federal spending for domestic purposes with the amounts "handed out" by the United States to foreign countries. For the five fiscal years from July 1, 1948, to June 30, 1953, "and for power facilities in Europe only, this country handed out a minimum of $1,084,000,000. This compares with spending for own public power program of $2 billion from 1902 to 1953. Included in this are such dams as Hoover, Shasta, Grand Coulee and Hungry Horse, as well as the Central Valley and Columbia Basin projects," said Gross.

The convention re-elected J. E. Smith president, and John M. George vice president. Albert C. Hauffe of South Dakota was elected secretary-treasurer.

FINANCE AND REGULATION

Today's Utility Yields %



	BONDS			PREFERRED STOCKS			COMMON STOCKS		
QUALITY.....	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
Feb. 17.....	2.99	3.03	3.14	3.96	4.09	4.41	4.20	4.54	4.82
Feb. 10.....	2.95	2.99	3.13	3.97	4.09	4.41	4.22	4.60	4.89

Utility Earnings

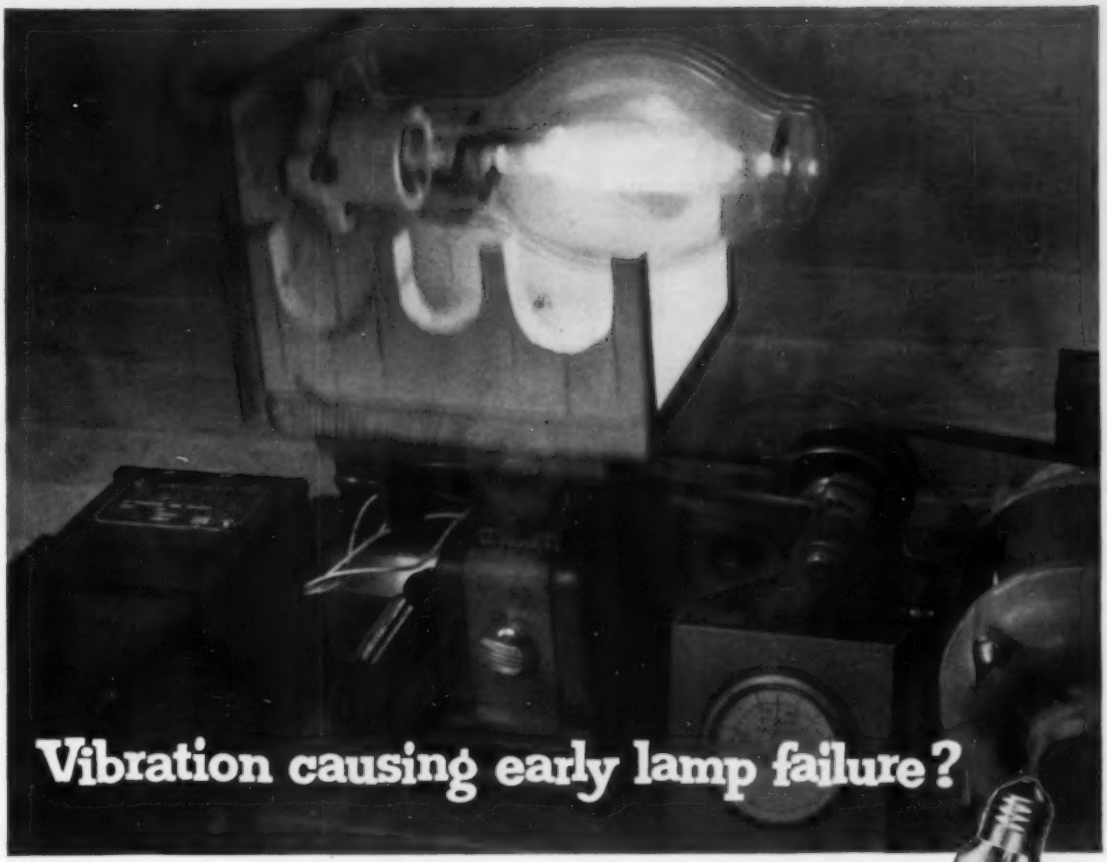
COMPANY	PERIOD MONTHS	ENDED	NET INCOME 1954	NET INCOME 1953	EARNINGS PER COMMON SHARE 1954	EARNINGS PER COMMON SHARE 1953
Arizona Public Service.....	12	Dec.	$4,589,000	$3,798,000	$1.42(a)	$1.36(a)
Cleveland Electric Illuminating	12	Dec.	14,063,000	14,765,329	3.86	4.07
General Public Utilities, consolidated.....	12	Dec.(b)	19,500,000	17,900,000	2.06	2.02
Philadelphia Electric and subsidiaries.....	12	Dec.	30,889,079	29,779,238	2.34(a)	2.38(a)
Portland General Electric.....	12	Dec.	4,346,352	3,821,465	1.45	1.27
Texas Electric Service.....	12	Dec.	10,341,053	9,039,073	....	....

Notes—All the figures in the above companies are subject to year-end audit; (a) Based on average number of shares; (b) Domestic subsidiaries only.

Utility Financing

COMPANY AND DESCRIPTION	AMOUNT OF OFFERING (000)	OFFERING PRICE	YIELD TO PUBLIC
WEEK OF FEBRUARY 17-23			
BONDS AND DEBENTURES			
Central Electric & Gas—conv. subord. debs 4¼% due 1970.....	$1,500	100.00%	4.25%
Texas Electric Service—1st mtg 3⅛% due 1985.....	17,000	102.127	3.14
SCHEDULE FOR FEBRUARY			BID DATE
BONDS			
Rochester Gas & Electric—1st mtg due 1985.....	$10,000	.....	Feb. 24
PREFERRED STOCK			
Carolina Power & Light—50,000 sh serial cum no par	.....	.....	Feb. 24(a)
COMMON STOCK			
Carolina Power & Light—505,000 sh.....	.....	.....	Feb. 24(a)
South Carolina Electric Gas—210,053 sh (to be offered commonholders on a 1-for-15 basis, record Feb. 24 to expire March 10 with oversubscription privileges. Owners of less than 15 shares can subscribe to one full share).....	.....	.....	.....

Note—(a) Merrill Lynch, Pierce, Fenner & Beane—R. S. Dickson & Co., underwriters.



Replace with ruggedized Sylvania Mercury Vapor Lamps...and save money

Rugged design . . . tough construction . . . rough tests . . . these are the quality extras that keep Sylvania mercury vapor lamps operating under rough vibration conditions—the extras that help you save lighting dollars.

For example, Sylvania's *ruggedized* resistor mount has been designed specifically to combat one kind of vibration that may cause lamp trouble. This solid mount—running directly through the resistor itself—anchors the resistor firmly—makes it an integral, vibration-resistant part of the lamp assembly.

For proof of ruggedness, Sylvania engineers check Sylvania mercury vapor lamps under relentless, high-vibration conditions—conditions that only the best built lamps can take. Why not check Sylvania ruggedness for yourself? Order Sylvania mercury vapor lamps now, and see how quality can help you cut lighting costs.

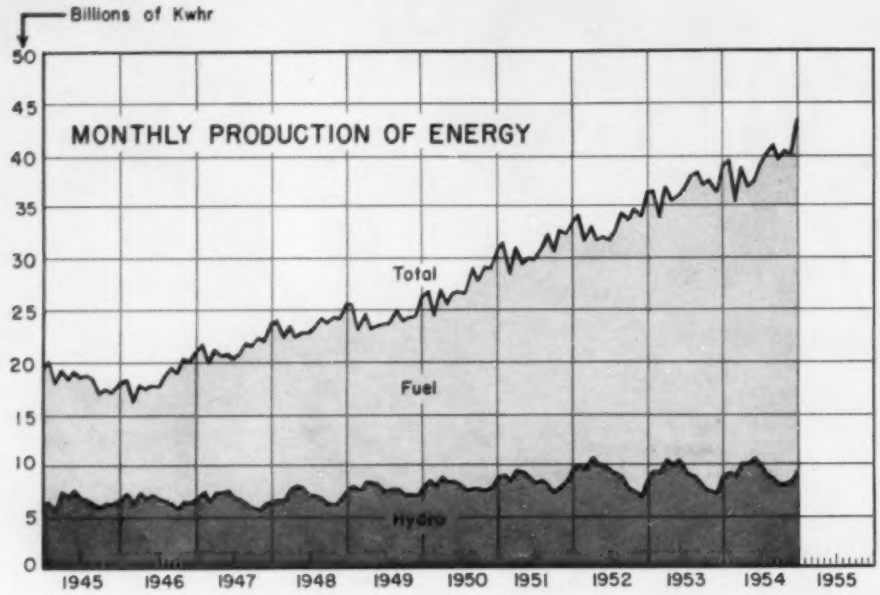
Sylvania Electric Products Inc.
Lighting Division, Salem, Mass.
In Canada:
Sylvania Electric (Canada) Ltd.,
University Tower Building,
St. Catherine Street, Montreal, P.Q.

- Lighting
- Radio
- Electronics
- Television
- Atomic Energy

Keep your eye on SYLVANIA

...fastest growing name in sight

STATISTICS



Power Statistics . . .

		Latest Month	Preceding Month	Year Ago	Annual Change %
Capacity	Dec.	102.52	101.12	91.49	12.1
Peak—Class I Systems, million kw	Dec.	85.5	81.9	78.6	8.8
Estimated Dec. '55 Peak	Nov.	96.1	96.2	98.3	−2.2
Production—billion kwhr	Dec.	43.43	40.22	39.08	11.1
hydro		9.05	8.12	8.67	4.3
fuel		34.38	32.10	30.41	13.1
Sales—billion kwhr	Nov.	33.87	33.75	31.59	7.2
residential		10.07	9.70	9.02	11.5
commercial		6.14	6.40	5.50	8.8
industrial		15.38	15.24	14.95	4.5
other		2.29	2.41	2.12	7.5
Fuel Consumption	Dec.				
coal—million tons		11.90	10.70	10.88	9.4
oil—million barrels		7.67	5.82	7.62	0.6
gas—billion cu ft		74.93	88.66	70.94	5.6
Net Income Class A & B Co's—$ million	Nov.	94.91	86.98	83.86	13.2
Residential Customers—millions	Nov.	43.04	42.95	41.89	2.8
revenue per kwhr		2.70¢	2.70¢	2.74¢	−1.5
avg. kwhr per customer		2,528	2,512	2,332	8.4
avg. annual bill		$68.26	$67.82	$63.90	6.8

Business Statistics . . .

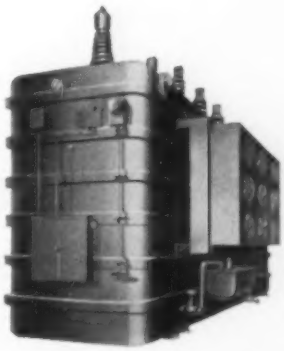
Indexes: 1947−49=100					
FRB Industrial Production	Jan.	130	128	124	4.8
ENR Construction Cost	Feb.	135.1	135.1	128.9	4.8
BLS Cost-of-living	Dec.	114.3	114.6	114.9	−0.5
NEMA Sales	Dec.				
insulation materials		138	124	133	3.8
electric appliances		84	90	69	21.7
household refrigerators		62	47	53	17.0
Wholesale prices	Dec.				
motors and generators		121.7	121.7	124.3	−2.1
transformers and regulators		128.1	128.1	128.1	.....
switchgear and fuses		135.3	135.3	135.1	0.1
GNP—annual rate—$ billion	4th Qtr.	362.0	355.5	360.5	0.4

Moloney Transformers, proven dependable performers, provide an uninterrupted flow of power . . . up along your high voltage transmission lines . . . down to your lower voltage distribution feeders.

Moloney has paved the highway of high voltage and Kva power transformers in their newly completed manufacturing bay . . . and Moloney HiperCore Transformers have provided dependable avenues of distribution . . . with no detours.

Whether you need high road power transformers . . . or low road distribution transformers . . . make them "Moloney All Along the Line." For Moloney is the "Sign of Quality" . . . of 58 years of experience in the exclusive production of transformers.

MEEK-42

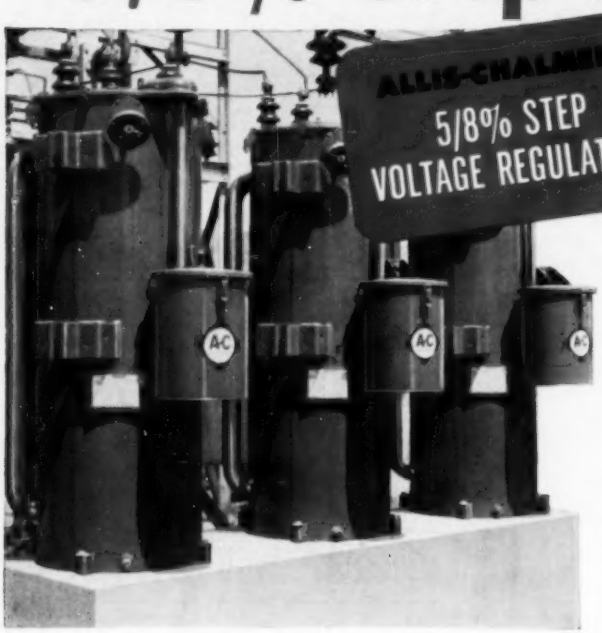


MOLONEY ELECTRIC COMPANY

Power Transformers • Distribution Transformers • Step Voltage Regulators • Regulating Transformers • Load Tap Changing Transformers • Load Center Transformers • Unit Substations • Network Transformers • Constant Current Transformers • Capacitors • Transformers For Electronics

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS 20, MO. AND TORONTO, ONT., CANADA

HOW to add revenue with 5/8% Step Regulators

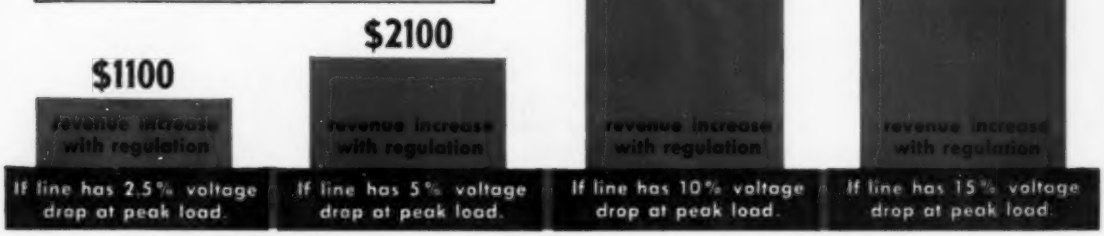


With only 5% low voltage at peak loads, you can increase revenue $2100 per regulator the first year by correcting voltage with an Allis-Chalmers distribution regulator. That increase is more than the regulator costs. Taking all factors into consideration, it's enough to pay back initial investment in less than two years, in most cases.

And you improve your maintenance picture too. With A-C regulators reducing or eliminating complaints due to low voltage, you get more from service crews and equipment. Use them where they are really needed instead of wasting manpower and money testing voltage at customers' homes.

Revenue Increase Per Year Per 1000 Kva Peak Load

Assuming: 90% Power Factor; 40% Load Factor; 50% Lighting Load; Energy Charge: 3¢/kwhr; Average Lighting Load Drop—70% of Peak Load Drop.


$1100
revenue increase with regulation
If line has 2.5% voltage drop at peak load.
$2100
revenue increase with regulation
If line has 5% voltage drop at peak load.
$5100
revenue increase with regulation
If line has 10% voltage drop at peak load.
$8000
revenue increase with regulation
If line has 15% voltage drop at peak load.

Low Maintenance, Long Life Proved by Experience

When you specify an Allis-Chalmers voltage regulator you know you'll get a unit with minimum maintenance, longest possible life. No other 5/8% step regulator gives you proof from years of actual field experience. Allis-Chalmers step-type regulators — all using the same basic designs — have been turning in excellent service records for over 20 years.

More facts are available. Get them from your nearby A-C district office or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-4565

ALLIS-CHALMERS